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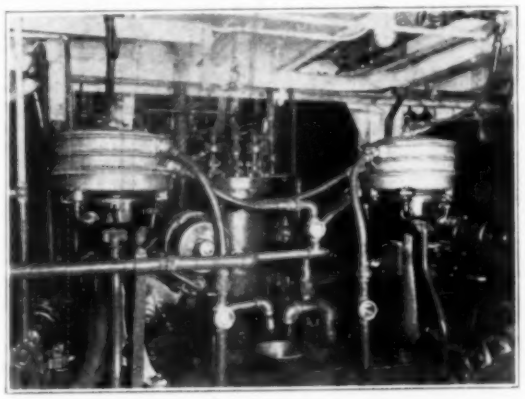
Castings Separate the Oil From the Water

ADAPTATION of diesel engines for the propulsion of ships, a movement which gained considerable momentum during the war, has created several problems in connection with the proper care of oil and waste. Discharge of bilge and ballast waters containing oil has caused the pollution of the seas and has led to the enactment of laws by the leading maritime nations prohibiting the dumping of oily discharge water in the respective territorial waters. Another problem requiring serious consideration arises



Purifiers of this Type Will Handle over 5000 Gallons of Lubricating Oil Each Day

from the carbon and other impurities which collect in the lubricating oil and which cause an unnecessary amount of wear if not removed. Presence of water in the fuel oil also requires attention if the ship is to be kept in service. These problems relating to matters of vital importance to the ships burning oil in the internal combustion engine, have led to the development of several types of oil separators. These machines work on the gravity principle and take advantage of the fact that oil and water are of different density. The foundry enters into the manufacture of these separators since the greater portion of the weight of the machines consists of cast metal.

Find Where Castings Can Be Sold

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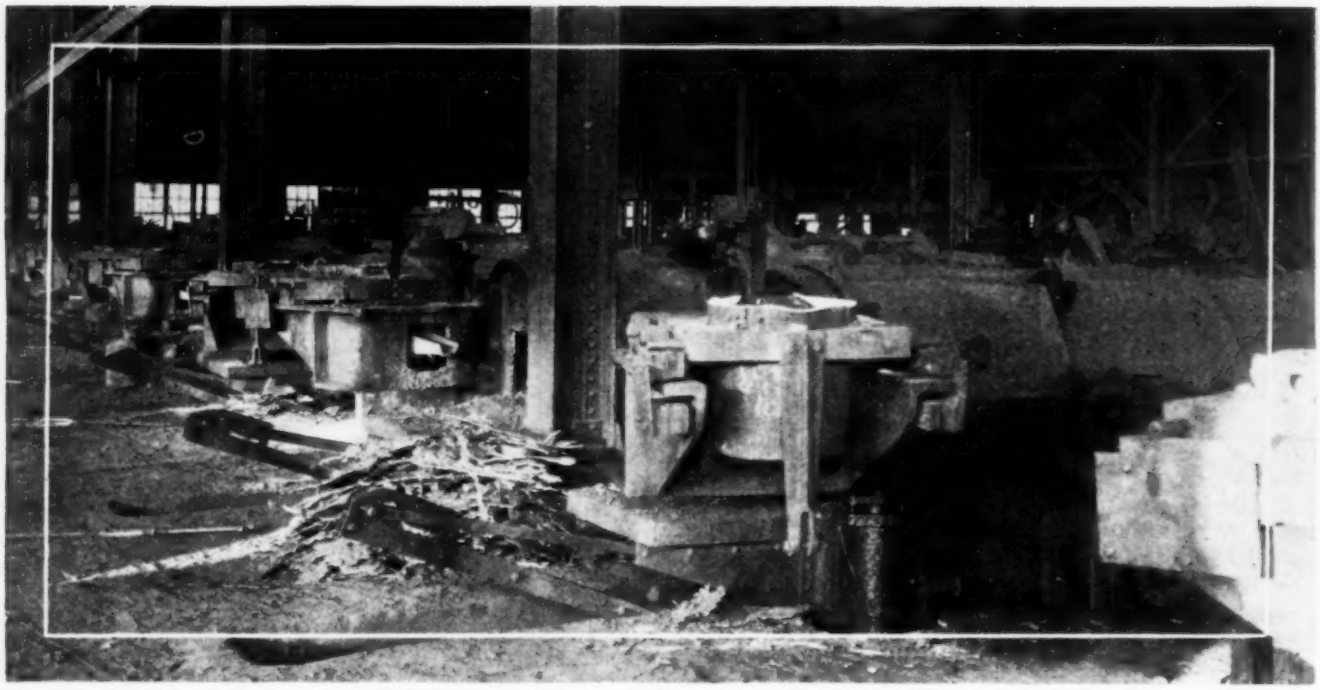


Casts Iron Pipe

In Spinning Green Sand Molds

Birmingham Establishment Introduces New Features in Pressure Pipe Plant—Plan Continuous Operation

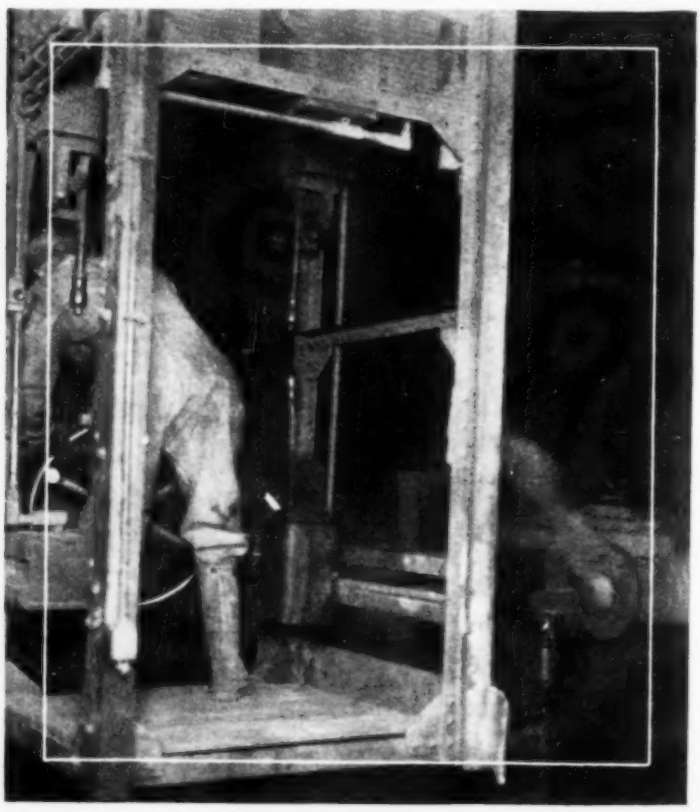


Fig. 1—Above—Two units of six machines each compose the entire battery of centrifugal casting machines erected at the end of the new shop, adjacent to the cupola building

By Dan M. Avey

Fig. 2—Traveling monorail cranes carry the metal from the cupolas to the casting machines. The operating cage is swung low on a level with the delivery ladle

SINCE the first ancient craftsman in metals found that by attaching his mold to a chain and whirling it about his head to force the molten contents to seek out the most intricate corners of the mold cavity, the idea of centrifugal force applied to casting problems has intrigued interest. The inertia effect which causes a rotating body to pull away from the center about which it is spinning has been applied in various ways to the art of founding. The idea itself is not new, but its practical application awaited the inventive genius of the present century. De Lavaud, a Brazilian, merits the credit for applying centrifugal force to make hollow cylindrical iron castings in this country and through him and his successors cast-iron pipe is made successfully in water-cooled metal molds revolved at high speed about a longitudinal axis.

Another name has been added to the roster of those who have applied this basic force in a commercial way to cast-iron pressure pipe. W. D. Moore, president, American Cast Iron Pipe Co., Birmingham, Ala., conceived the idea of setting this force to work, still retaining the effects of sand molds upon the physical characteristics of castings made therein. Mr. Moore has developed this idea and through his strength of purpose and engineering ability has built and put into operation the first commercial centrifugal cast iron pipe plant using molds lined with green sand. Although he ascribes credit for development of this plant to his associates, the general layout and many of the detailed features are his own and should be so credited.

Preliminary training fitted Mr. Moore for the task that he has accomplished. While his preparation was not directly along the lines of foundry experience, it gave him a broader foundation of general knowledge which he has applied in an ingenious manner to the construction of the centrifugal sand-cast pipe for the American company. In fact, he has worked many times exactly contrary to some of the previously accepted theories of foundry practice. In other instances he has adapted the best of foundry procedure to the engineering of this unusual plant.

A brief mention of this interesting plant was carried in THE FOUNDRY May 1, 1926. This was shortly before it was placed in full time operation. Today, it is working double shift and shortly is expected to be placed in 24-hour continuous operation.

Fig. 3—As each of the pouring ladles is filled, the delivery ladle is moved along to the next machine

The rapidity with which the plant has been built and placed in service may be gained from a remark by J. W. Moore, general manager, who says: "On the 19th of October, 1925, we had just a desire for a plant and on July 1, 1926, we cast the first pipe."

Today, 12 casting machines, constituting two complete units are spinning the full 16 hours, producing their quota of 16-foot, cast-iron, bell and spigot, pressure pipe, while the towering double unit prepares and delivers the molding sand to two molding stations at each of which six pipe molds are made at the same time. One cupola of a battery of three supplies the metal and two shakeout or sand removal machines are employed supplementing the casting machines.

The present plant represents the culmination of a series of experiments on centrifugal castings which were started as early as 1917 and continued intermittently through 1922. At the latter date more intensive attention was given to the problem and during 1923, 1924, 1925 and through the present year approximately 20,000 tons of centrifugal pipe, cast in sand molds has been produced and placed in service. The pipe made in the early stages all was in 12-foot lengths.

A review of some features of the article which appeared in the May 1, 1926, issue of THE FOUNDRY may serve to give a better idea of the arrangement of the present complete plant. As will be noted from the accompanying drawing, the entire centrifugal casting shop is under one roof. Along one end of the building 12 casting machines are spaced in pairs. Over these machines two bridge type cranes are provided, serving to deliver and remove the flasks. Each serves a battery of six casting machines. Immediately at the right will be noted at *B* the two sand removal stations from which the pipe are taken inward to the center to be passed through a cooling oven. At *C* and *D* are the two molding stations, each accommodating six molds at a time in units of three. In the center and covering the space from *E* to *F* is the sand-handling system which extends beneath the floor level for a distance and then by one elevating stage to the right and two to the left to a central storage tank in a manner which will be explained. At *G* and *H* will be noted the dipping tanks where a coating of tar is applied to the finished pipe and *I* and *J* are the testing stations where pneumatic or hydraulic pressure, as desired, is available to test the pipe before final delivery to the storage yards *K*.

Split Into Batteries

The 12 casting machines are divided into two batteries, two 4-inch and four 6-inch units, and two each of the 8, 10 and 12-inch molds. The casting machines are readily interchangeable, and all may be adapted to take different size molds within a period of two to three hours. Casting machines, the heart of this system of making pipe are unique and perhaps should be described first to give an idea of the requirements about which this closely synchronized plant has been built.

Each machine consists essentially

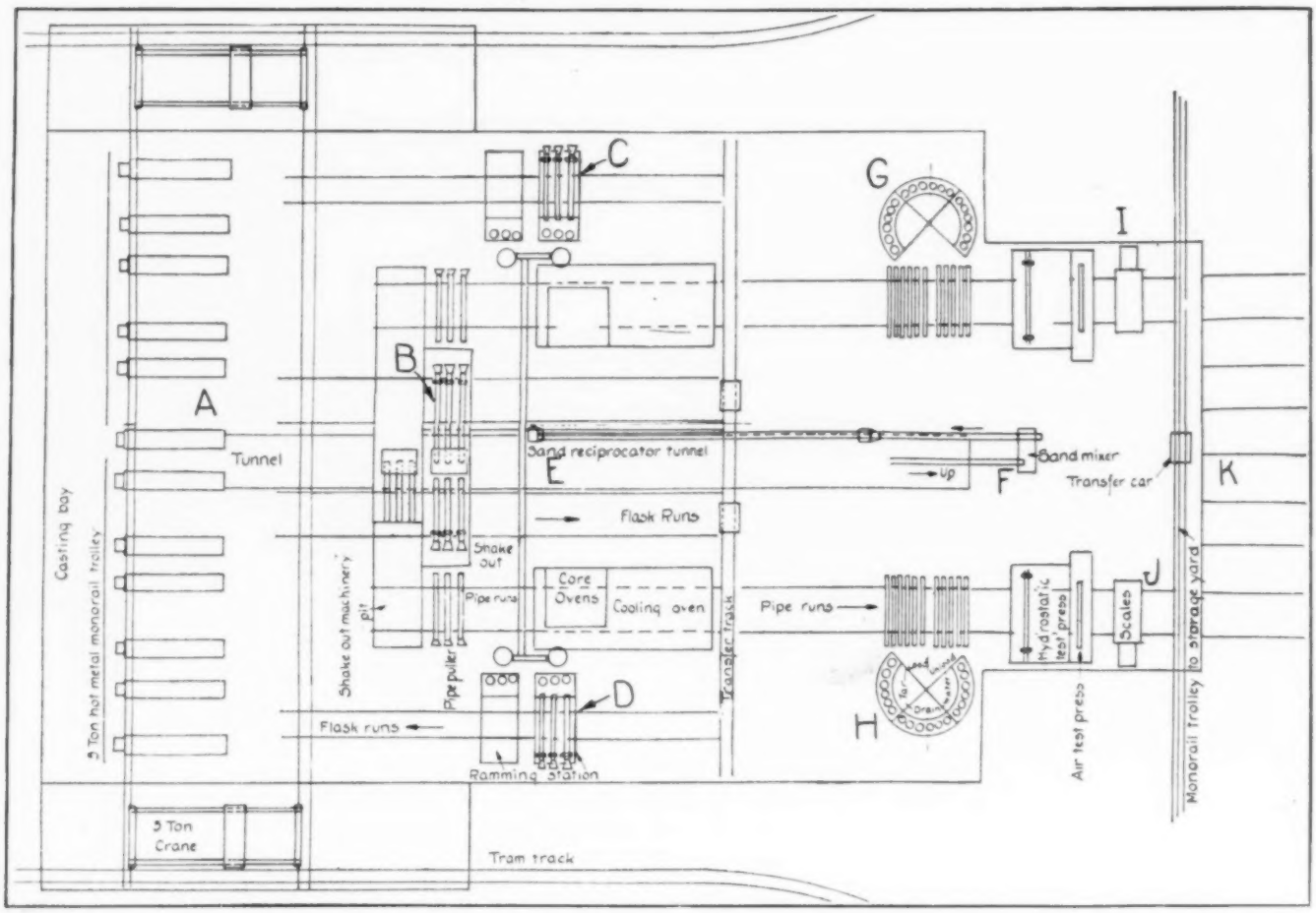


Fig. 4—The entire plant is housed under one roof. The casting machines occupy one end; the shakeout, cooling chambers, sand handling and molding are in the center, and the dipping and testing stations are placed in the opposite end

of an outer shell, within which a cylindrical flask, containing a sand mold for a pipe, is placed and rotated at sufficient speed to impell the molten metal, when admitted, to the outer wall, thus forming a pipe without the need for a central core. The lower portion of this shell, as it may be called, is in reality a heavy machine base, carrying at one end the motor for rotating the mold and at the other a carefully designed tilting pouring ladle. The base or lower half of the shell is hinged near the end carrying the drive motor and a hydraulic ram near the opposite end serves to elevate the pouring end until the shell, containing the mold tilts downward toward the bell end at a slope of about $\frac{5}{8}$-inch in 12 inches. The lower portion of the shell, or base, carries two sets of rollers or bearings, upon which the flask rests while rotating. Separate from the base, but within it is a lifting mechanism, which when the machine is open carries two cross arms, actuated by separate hydraulic plungers, that raise the mold off the bearings upon which it is rotated while the casting is in progress. The upper portion of the shell is a hood or cover, supported at the four corners by hydraulically operated columns that raise the hood for admitting or removing the molds. This hood also has two sets of rollers or bearings, which when the machine is closed rest upon the flask, acting as idler bearings to hold the flask firm-

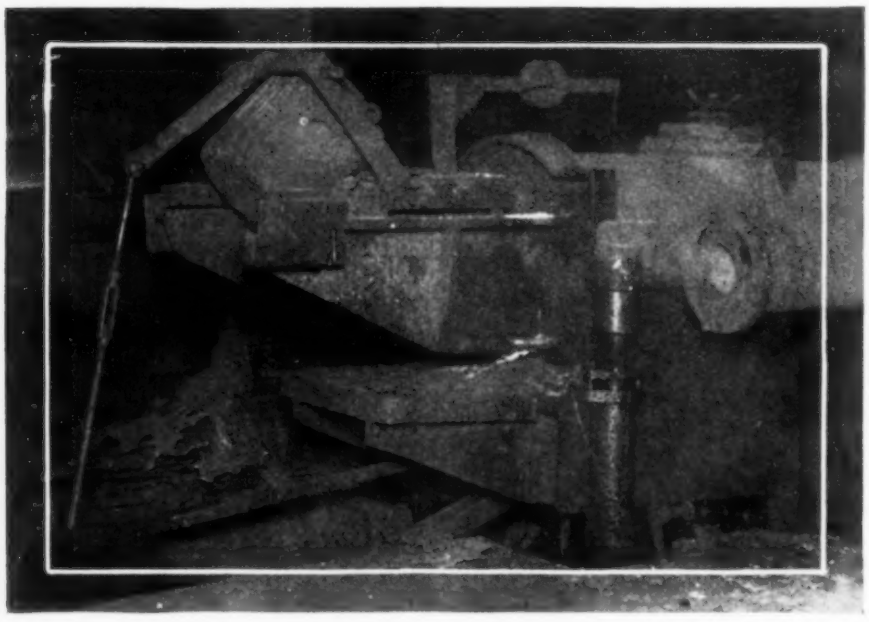


Fig. 5—The pouring ladle, containing the exact quantity of metal required, is tilted and pours its charge through a runner into the spigot end of the mold. Note the elevation of this end of the machine in pouring

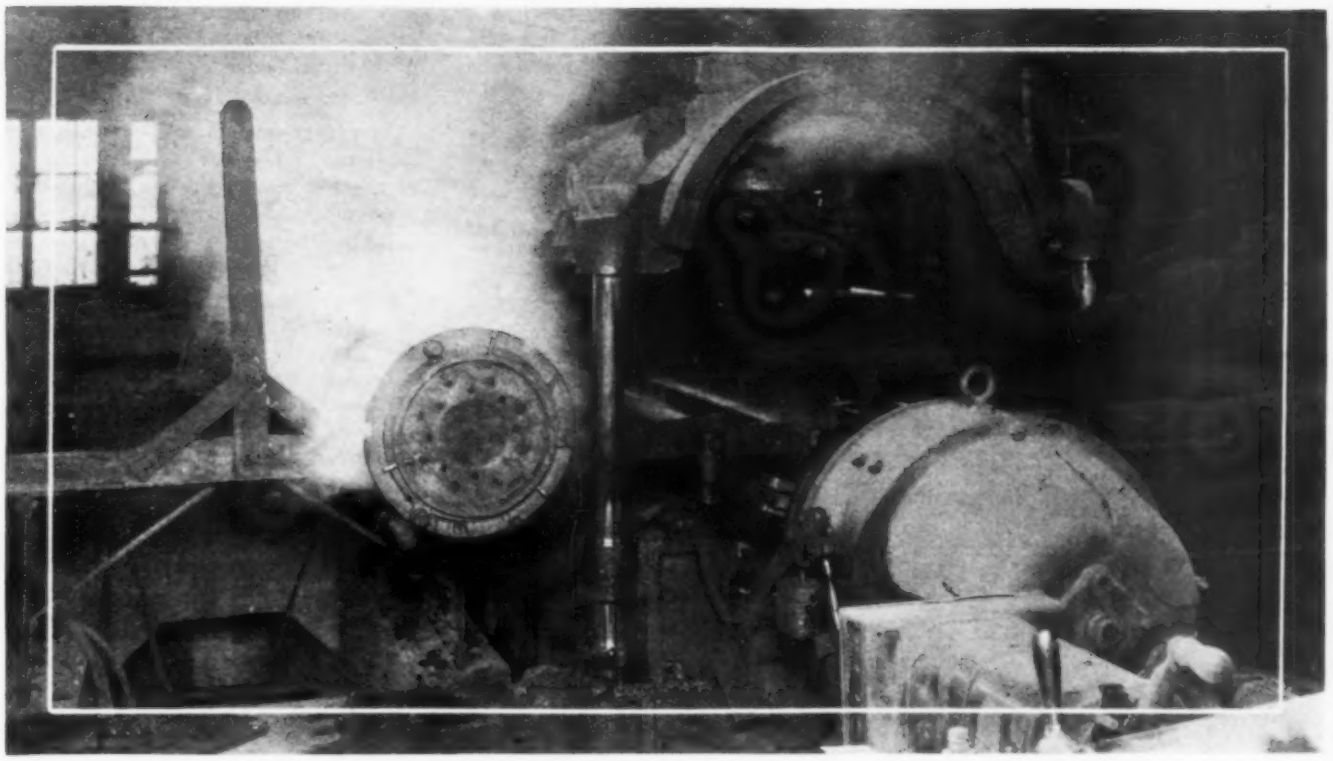


Fig. 6—After the pipe has solidified in the mold, the hood of the machine is lifted, the clamps connected to the drive motor are released and two T-head hydraulic pistons raise the flask and permit it to roll free from the machine. Note the steam, indicating the moisture in the sand mold

ly on the supporting bearings directly beneath.

Operation of the casting machine is simple, but effective. While in a level position, the hood is raised. A flask, containing a rammed sand mold, with a plate holding the bell core clamped by three wedges to one end, and a cover plate at the opposite end, is rolled in to rest upon the central cross arms raised to a height level with the delivery rails running at right angles to the machine. These cross arms then are lowered, so that the flask rests upon the lower pair of bearings. The coupling mechanism, on the drive motor then is affixed to the bell end of the mold, three hinged clamps engaging three slots in the edge of the enlarged flange on the belt end of the flask. The hood then is lowered so that the upper bearings hold the flask firmly. The flasks are machined accurately to center on suitable rings, which form an integral part of the flask and provide a bearing surface for the upper and lower bearings. These are given a dash of oil before the hood and upper bearings are lowered into place.

A predetermined and accurately measured quantity of iron then is placed in the ladle supported upon

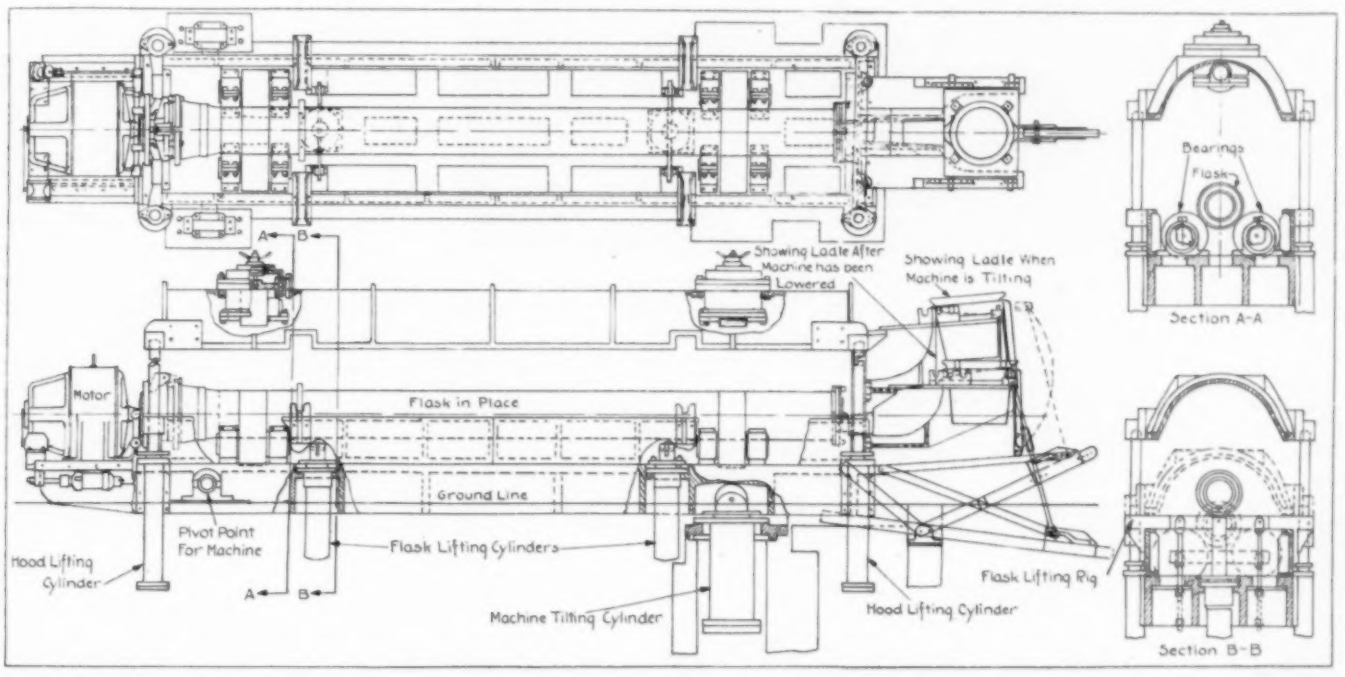


Fig. 7—General features of the casting machine, showing the method of introducing and removing the flasks

a weighing device, mounted on the end of the machine opposite the drive motor. An arm and sliding counterweight permits the delivery ladle to place just the amount of metal required in the pouring ladle to make the desired size pipe. A hinged arm then is attached to the outer edge of the pouring ladle supporting rig. The tilting ram, near the flask end of the machine then is set in motion, raising the end of the machine holding the pouring ladle. This tilts the pouring ladle allowing the molten metal to run through a runner into the spigot end of the mold and thence slowly toward the bell end of the mold.

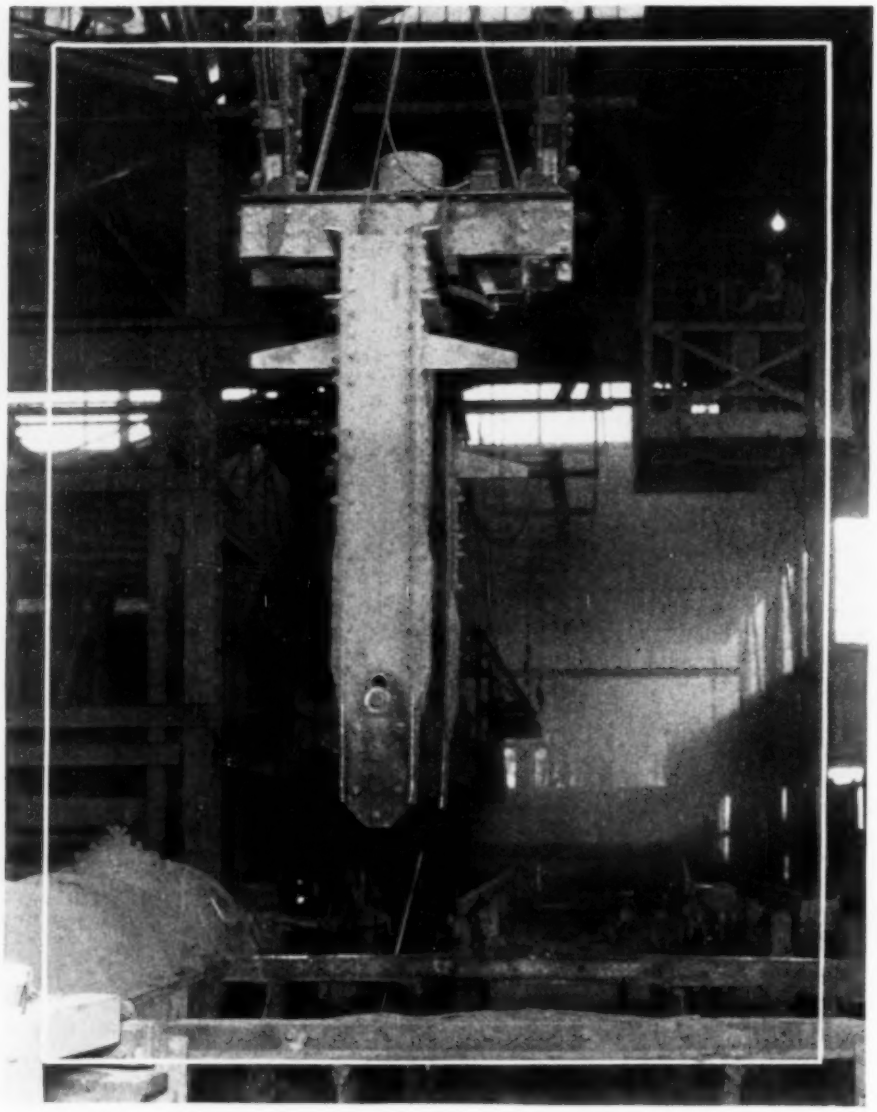


Fig. 8—A special lifting rig, operated entirely from the crane cab picks up and carries the flasks, delivering them to the machines, and returning them to the sand removal station

Starts Whirling

Simultaneously, the drive motor is set in motion, turning the flask slowly at just sufficient speed to prevent the entering metal from scouring the surface of the sand while at the same time, drying the inner surface of the mold. A uniform skin drying effect is achieved in this operation. Then, as the metal approaches the bell end, the machine is lowered to its level position and the speed of the motor is accelerated automatically and gradually to full casting speed. This speed is maintained until the metal has solidified.

Rotation then is stopped, the pouring ladle, which has remained tilted is returned to a level position, the tilting arms uncoupled and the entire pouring rig swung around at right angles to the machine to permit cleaning any encrusted metal remaining in the runner trough. The hood then is lifted, the motor drive mechanism quickly uncoupled and the flask, containing the pipe casting is lifted to a level with the receiving rails, which like the delivery table are at right angles with the machine. The flask is rolled out on this receiving table at the opposite side of the machine to that at which it entered and the cycle of operation is repeated.

Two men attend and operate three machines. One at the pouring end cleans the runner trough, couples and uncouples the tilting levers which actuate the pouring ladles and assists in placing and removing the flasks. The other at the drive end of the machine handles the controls for all the hydraulic lifting and tilting mechanism, observes the timing of the various operations, attaches and removes the mechanism which couples the drive motor to the flask and sets the motor in motion to spin the mold.

Automatic equipment for regulating the speed of rotation has been provided. The time element in synchronizing the various sequence is so nicely adjusted that but little is left to human judgment.

Balance Operation

When the operator has closed the machine by lowering the hood in place, he admits water to the tilting cylinder, thus raising the pouring end of the machine. No metal is admitted to the mold during the elevating operation. When the spigot end is in the full elevated position, the operating rod is inserted at the outer edge of the pouring ladle. Then as the machine lowers, the ladle automatically is tilted, accomplishing the pouring. The operator regulates the speed at which the machine is lowered to a level, thus determining the rate of admitting the metal.

The operations all are synchronized and all the operator has to do is regulate the hydraulic valve which sets the machine in motion from its elevation back to level. The rate of flow of the water out of the elevating cylinder controls the speed with which the machine resumes its level position. The electrical control is timed to throw the rotating motor to full speed as soon as the machine is back to horizontal. The speed of rotation advances from the slow speed of pouring to full high speed, when the metal is thrown to the outer face of the mold. Then the rate is reduced to about 25 per cent of the highest speed until the casting is solidified when the automatic control trips off and the flask comes to rest as the motor stops.

A revolution counter connected to the dead end of the motor shaft permits all speeds to be checked. The motor then is shut off and permitted to come to rest, the hood raised, the coupling removed and the flask raised

and rolled out upon the receiving table.

Hydraulic pressure of the various operations outlined is supplied from a central source, maintained at 500 pounds per square inch. A 15 horsepower, variable speed motor, made by the Reliance Electric Co., Cleveland, supplies the power for spinning the molds. The speed of rotation of the pipe varies from 500 to 1500 revolutions per minute, the large pipe requiring, of course, a greater amount of molten metal, but a slower rotative speed. The determining factor, the peripheral speed is practically uniform.

Cranes and rigs for handling the flasks and poured molds are sufficiently unusual to merit more detailed description. Two cranes provide service of this nature for all twelve casting machines. Each of the pair of cranes is a special 5-ton, high-speed, bridge-type traveling unit built by the Niles Crane Corp. Philadelphia.

A circular plate, similar to a turntable platform, is fastened rigidly to the yoke and provided with slots which are engaged by magnetically operated dogs. These serve to lock the hanging yoke either parallel with or at right angles to the crosshead.

Each end of the yoke is provided with two short steel members, which when dropped outward, form a V-shaped support. These members are hinged to the sides of the yoke and when raised are locked within recesses in the sides. Short triggers extending outward from the sides of the yoke above, serve to release the lower members as desired.

In operation, this lifting rig is so ingeniously contrived as to eliminate all need for manual hooking on to the flasks. The craneman handles the flasks by operating entirely from his cage without any assistance from the ground. With the yoke at right angles to the crosshead, but parallel to the brige of his crane, the operator drops the rig down between two flasks on the delivery rails, upon which the flasks have been rolled from the tilting table after molding. As he drops the yoke downward until the ends are well beneath the level of the flasks, the two triggers on each arm of the yoke strike the flasks. This permits the four hinged arms near the ends of the yoke to open outward from their recesses. These form a cradle at each side of the yoke, of the two hinged members. As the rig is raised the flasks are picked up gently from the rails in these cradles. They are turned an angle of 90 degrees in a manner which later will be explained. This makes them parallel to the molding machines.

They then are carried to the proper position over the rails between two casting machines and lowered, until the flasks rest upon the rails along side and between two casting machines. The rig is lowered with the ends of the yoke going down into openings beneath, just sufficient to pass the ends of the yoke, but pushing the hinged members back upward into their recesses until they again are locked. The yoke is drawn up from between the flasks leaving them in position to be rolled into the casting machines at either side, one to the right and the other to the left.

When removing the completed flasks with their new castings, the operation is reversed. The yoke is lowered between the two poured flasks, until the extended triggers release the lower hinged members. The rig then is raised, picking up the two molds in their cradle-like support at the side of the yoke. As the crane lifts the rig, it is traveled long, causing one end of a flask to strike an upright structural member placed for that purpose. This starts the yoke turning, the magnetic lock having been released, and as the crane travels toward the center of the shop to deliver the flasks to the sand removal station, the yoke slowly turns until it is at right angles with the bridge of the crane, where the magnetic locking dog again drops into a slot and holds it exactly in position to deliver the flasks.

FOUNDRYMEN who attended the convention and exhibition of the American Foundrymen's association in Detroit in September probably will recognize many of those gathered around the festive board, for the group is composed of prominent Detroit foundrymen, their wives and friends who were so successful in entertaining the guests and delegates at the International Foundrymen's congress. The banquet of the Detroiters was held in the Crystal Room of the Book-Cadillac hotel, Detroit, on the evening of Nov. 9.

This is the first of a series of two articles on the centrifugal casting plant of the American Cast Iron Pipe Co., Birmingham. The second will appear in a subsequent issue.

Renews Bond in Sand Heap

Theories and Conclusions Drawn from a Series of Experiments Conducted Over a Period of Several Months at an Eastern Plant

By T. F. Kiley

CONSTANT addition of new sand formerly was required to maintain uniformity in the condition of our sand. To make room for the necessary amount of new sand we were obliged to cart 4 tons of old sand daily to the dump. A series of experiments was instituted with two objects in view, namely to reclaim the old material and to impart extra strength to the heaps without seriously affecting the permeability. The experiments were based on the use of a concentrated bonding element, a species of fire clay, instead of the usual new sand in which the bond by no means is the largest factor.

The first batch of sand selected for trial was taken from the pile scraped from the heavier castings in the cleaning room. This sand was screened through a No. 6 riddle and with a 6 per cent addition of clay was mulled for 3 or 4 minutes, then tempered and aerated. Satisfactory castings were molded in this mixture. They were a little rougher than the castings produced under regular conditions, but this feature probably could have been improved by using a firmer screen. Labor expense connected with the preparation of this sand rendered the process uneconomical, but this initial experiment indicated the possibilities of adding clay to the regular sand heaps.

In a second experiment heavy foundry gangway sweepings ordinarily scheduled for disposal on the dump were screened through a No. 6 riddle, mulled with a 3 per cent addition of clay in batches of 420 pounds, tempered, aerated and then spread over one of the regular sand heaps in the heavy work foundry. The heap was used for six days without any further treatment except the usual cutting and tempering. Shrinkage of the heap at the end of six days necessitated the addition of further similar material. Castings were as satisfactory in every respect as those made under former conditions. The sand held up well and seemed to retain its *life* longer than it would if it had not been treated.

Facing sand was made from heavy foundry gangway sweepings with 3 per cent clay and the usual amount of coal dust mulled for about 3 minutes. This material was tried on a few castings at first, but over a period of 2 weeks its use gradually was extended until during the concluding days of the period it was used exclusively. The castings showed a marked improvement. They were not so hard to clean and in the aggregate they presented fewer cuts, scabs, pits, drops and other defects traceable to sand than formerly.

On Light Work

Gangway sweepings from light foundry ordinarily destined for the dump were passed through a No. 8 riddle, mulled with 2½ per cent clay and given to a molder in the light foundry as medium sand for bench work. Castings made in this sand turned out as well if not better than those made in the regular sand heaps adjoining. The heap was in use for 10 days without any apparent deterioration in quality. Shrinkage in volume at the end of that period necessitated the addition of further synthetic material. In this instance also the treated heap held its life much longer than ordinarily would have been the case.

Success in the foregoing instances suggested the idea of converting local core or sharp sand into molding sand. A batch containing 91.5 per cent core sand and 8.5 per cent clay was prepared and tried out as molding sand on medium weight castings. A little wash was noticeable, but in general the surface was excellent. The work was not carried to completion, but we believe that a 12 per cent clay addition would have given greater strength and insured better results.

Facing sand made from a mixture of fine core sand with an 8½ per cent addition of clay and the usual amount of coal dust worked quite as satisfactorily as the facing prepared in the regular manner. In fact the surface of the castings poured against this special facing was smoother than the castings poured against the regular facing, due probably to the fineness of the core sand grains and also to the added refractoriness. The two foregoing tests lead logically to the conclusion that the production of satisfactory molding sand from clay treated core sand is quite feasible and economical.

Facing sand made from coarse core sand and bonded with 15 per cent clay produced a rough surface. Fine sand showed a tendency toward closeness and the coarse sand was too open. A judicious mixture probably would have yielded an ideal combination.

Since the first of October 1925 all the facing sand has been prepared from clay treated gangway sweepings from the heavy foundry. Similar waste sand from the light foundry has been mixed with 5 per cent clay and returned to the various sand heaps in lieu of new sand.

Up to the present the treated sand is working out as well as it did in the preliminary tests. At first the molders objected to cutting over the treated sand. They claimed that on account of the extra strength imparted by the clay, more effort was required to prepare the heaps for use. The sand now is cut mechanically and that objection has been removed.

Some of the molders claimed that the sand did not take water as readily as a regular heap, also that it was harder to swab and patch. These objections, due to the extra clay content could be removed by reducing

Sand Problems Important

CONSIDERABLE interest has developed in the past few years in the various problems connected with the control, conservation and reclamation of foundry sand. No problems have received greater attention at the annual conventions of the American Foundrymen's association and at the gatherings of foundrymen in the numerous foundry centers throughout the country. Results of a series of experiments in the reclamation of foundry sand are given in this article, which should prove a valuable addition to the information constantly being collected on the subject. The article is from a paper presented at a recent meeting of the New England Foundrymen's association. The author, T. F. Kiley, is connected with the research department of the Brown & Sharpe Mfg. Co., Providence, R. I.

the amount, but the objections did not seem serious enough to warrant sacrificing the strength of the sand.

As a matter of general interest W. M. Saunders, who was chairman of the joint committee on molding sand research of the American Foundrymen's association, selected samples from our heavy and light foundry sand heaps and ran tests on them for moisture, bond and permeability over an extended period. Among the significant points noted are that permeability with average moisture content of 7.00 per cent has increased steadily, starting at 15.7 and giving a result of 25.8 after the sand had been used steadily for 16 days. This probably may be due to some of the adjoining grains becoming cemented. With moisture at 7.25 per cent the permeability on the regular heaps was 25.8 and 28.

Bond as indicated by compression test decreased rapidly during the first 5 days, but afterward remained fairly constant. The heap started with a compression test of 8 pounds which dropped to 4.7 pounds after the fifth day and was down to 3.6 pounds on the 16th day. Compression test on two regular heavy foundry heaps rejuvenated daily with new sand showed 3.5 and 2.4 pounds. From the foregoing it is apparent that the clay treated heap is the stronger.

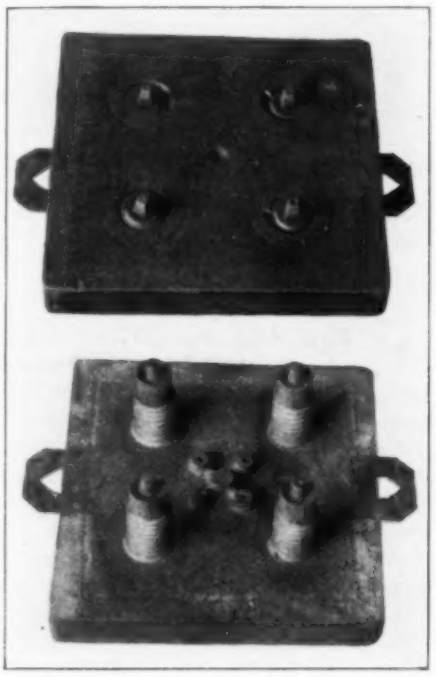
Moisture on heavy foundry clay treated heaps average about 7.00 per cent, while that in the regular heaps is 7.25 per cent. The optimum water content was found to be about 7.50 per cent. In this respect the heaps containing nothing but sand seem to have a slight advantage. Results of tests on the light foundry heaps checked closely with those on the heavy foundry sand. On account of the natural shrinkage of the heaps two 800-pound loads of clay treated sand had to be added during the period of the tests.

Results of Tests

Permeability on the light foundry heaps increased steadily from 12.2 at the start to 16.7 after the sand was in use for 16 days. Moisture varied between 5.75 per cent and 7.50 per cent with an average of 6.50 per cent. Permeability on the regular heap with 6.50 per cent moisture was 17.3.

Bond as indicated by compression test decreased rapidly during the first 5 days, but afterward remained fairly constant. The heap started with compression test of 5.4 pounds which dropped to 3.1 pounds after 5 days and remained at 3.0 pounds for the remaining 11 days of the test. Compression on regular heap to which new sand constantly is added is 2.9 pounds with a moisture content of 6.76 per cent. Apparently the two additions of treated light foundry sweepings was sufficient to keep the strength above that of the regular heaps.

No definite relation was established between strength as indicated by dye absorption tests and strength as found by compression test. Compression strength was higher on some samples even with a lower dye absorption value than others. No difference was noted by fineness test to account for increase in permeability throughout the series. Possibly cementation of



THE COPE SIDE OF THE PATTERN IS SHOWN ABOVE WITH THE DRAG SIDE BELOW

grains is destroyed in making this test. Clay substance decreased on light foundry clay treated heap from 13.76 to 10.98 per cent after 21 days' use. On the regular heap this figure is 12.20 per cent. Clay substance on clay treated heavy foundry heap decreased from 16.00 to 13.96 per cent in 21 days. In the regular heap this figure is 12.5 per cent.

Permeability on heavy foundry heaps started at 15.7, reached a maximum of 25.8 on sixteenth day, dropped to 20 on eighteenth day, dropped farther to 19.0 after 27 days. Permeability on light foundry heap went up steadily from 12.2 to 18.4 in 27 days.

We are not yet positive on the cause of increased permeability with clay additions, but we are inclined to agree with the theory advanced by R. F. Doty in a paper presented at the Rochester convention of the American Foundrymen's association. This paper was published in THE FOUNDRY Dec. 15, 1922 and also is incorporated in Vol. XXX *Transactions* of the American Foundrymen's association. Mr. Doty pointed out that the increase in permeability was due to the fact that the continued addition of clay caused the sand grains to assume a rounded shape. To the objection that the grains eventually would grow too large, he stated that this feature was taken care of automatically. Each time the sand was prepared for use, the extra coating or coatings of clay spalled off almost entirely and the individual grains of sand retained approximately their original shape and size.

Screw Patterns Backed Out of the Sand

Rather unusual pattern equipment for making adjusting screws for babbitted bearings is shown in the illustration at the left, with the cope side above and the drag side below. In practice the pattern for the four screws is placed on the bench or machine and a drag is rammed and rolled over in the usual manner. The cope then is rammed on the upper side of the pattern plate and removed. The four square projections on the cope side serve a double purpose. After the cope has been removed and while the pattern plate still is in place on the drag, a wrench is applied to each of the square knobs in turn and each of the patterns is screwed up through the plate and removed from the mold in that manner.

The impressions these knobs leave in the cope serve as prints to steady and hold the center cores later. Instead of using a set gate, a small gate is cut in the sand leading to each screw mold after the pattern has been removed. The four gates meet in the center under a central vertical runner in the cope. The core which extends through the mold for each screw, is circular in cross section for approximately half its length. It is square for the remainder of the distance.

Appoint Distributors

Botfield Refractories Co., Philadelphia, has appointed the Curtis Supply Co., Buffalo; Waldredh Supply Co., Des Moines, Iowa; South Side Foundry & Machine Works, Charleston, W. Va., and the Empire Machinery & Supply Corp., Norfolk, Va., as distributors of its products.

Russians Use *Rotating* Arc Type Furnace

By Leonrde T: Aronoff

ELECTRIC furnaces are made in various types and designs for melting metals and each has its advocates. Furnaces may be divided into four classes, the arc, induction, resistance and recently, the high frequency furnace. Each class has its subdivisions whereby the furnaces in that class differ from one another. Generally, electric furnaces of different types and designs working under the same conditions, operate with the same efficiency and indicate that electrothermic melting has reached a high stage of development. As a group, the arc furnaces have distinguished themselves and have gained much practical application due to their simplicity and reliability. Nevertheless, these furnaces have certain limitations which are dependent on the nature of the arc used in melting. The main difficulties are:

Low working voltage. Generally, 60 to 110 volts which makes it necessary to use extremely high current. This complicates electrical equipment and makes it more expensive.

Intense fluctuations of loading in the electrical system which are caused by the changeability of the arc resistance. Bad *boils* in the molten metal, exposed patches of clear metal and scrap falling against the electrode causing a short circuit, create heavy power surges and place undue strain on the regulator system.

Concentration of heat in the small area of the arc. This creates an unequal heating of the metal. Convection of heat from the arc to the metal becomes more difficult as melting proceeds, due to the decreasing surface of the arc.

Voltages at which electric furnaces may work depend on the insulation of electrodes from the roof. Provision of a safety margin to protect the furnace attendants also must be made. Snyder in the *Electrical Review*, 1917 mentions the use of 220 volts. No doubt voltages even higher may be used but with the attendant difficulty of maintaining the arc. Rise of voltage follows the elongation of the arc which usually causes instability of arc.

On the other hand we may assume that the conditions during the burning of the arc in the electric furnace, such as powerful intensity of arc and high temperature of the surrounding space, are likely to promote greater stability. Fluctuations of loading in the circuit of arc furnaces commonly are lowered by applying furnace transformers with high coefficients of inductance, or by the use of reactance coils. The latter are more applicable and due to the elimination of fluctuations or surges in power, place the electric furnace in the same category as other equipment consuming electrical energy.

Concentration of heat at the arc is greatest in small furnaces which recently have been installed in many foundries. Prof. Hering in *Chemical and Metallurgical Engineering*, 1913 rightly maintained that each pound of metal should be held in the furnace for the minimum time. Holding the metal too long in the furnace increases

Method Is Novel

AT ONE time Russia was noted for her master artisans in founding of various metals. Russian craftsmen turned out remarkable small castings such as statuary, jewel cask etc., that were extremely intricate. These castings are noted for their accuracy of modeling and wealth of detail. Some of the castings were shown in the October, 1917 *issue of* THE FOUNDRY. *Since the war little has been heard from Russia, due to internal conditions and to the period of reorganization. However, Russian investigators have not been idle during this period as a perusal of this article will show. Efficient induction furnaces have been constructed as well as efficient arc furnaces, but employing the characteristics obtained by the use of an exciting coil to cause a rotation of the arc is novel.*

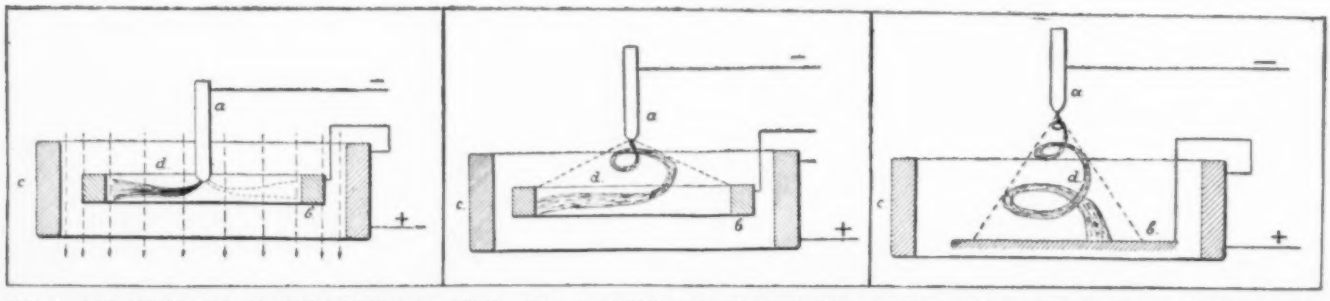


FIG. 1—ROTATING ARC IN THE FORM OF A DISK. FIG. 2—ANNU LAR ELECTRODE CAUSES ARC TO FORM IN A CONE SPIRAL. FIG. 3—FLAT ELECTRODE GIVES THE ARC THE FORM OF A ROTATING CONE SPIRAL

costs as well as resulting in over heating or in excess oxidation.

To promote good transmission of heat from arc to metal as well as to avoid local overheating, some furnaces are designed to swing or rotate during the melting period. Other furnace manufacturers enlarged the extent and heat radiating surface of the arc. In one type the arc was increased in length to 150 millimeters (5.9 inches) instead of the usual 40 to 60 millimeters (1.6 to 2.4 inches). Another method employed is that of blowing the arc by a magnetic field that surrounds the vertical electrode.

This same effect may be increased further by causing the arc to rotate under the influence of a magnetic field produced in an exciting coil. This method of arc propulsion was developed in Russia by Profs. Evreinoff and Telny. Fig. 1 illustrates the method of rotating the arc. Arc *d* is burning between carbon electrode *a* and the annular electrode *b*. Coil *c* is connected in series with the arc and excites a magnetic field in a vertical direction which causes the arc to rotate in the form of a disk.

Fig. 2 shows the form of an arc having the lower end of the carbon electrode outside the annular electrode. This is the form of a rotating cone spiral. The same shape of arc is obtained by replacing the annular electrode with a flat one as shown in Fig. 3.

Due to the arc being a flexible conductor that varies its direction according to the movement of the gaseous medium surrounding it, and having a considerable cross section, particularly when powerful currents are applied, there always is present in the arc a horizontal bending force caused by the current and a twisting force exerted by the magnetic field. As Prof. Dinnic points out, the arc acts similarly to a rope with a free end twisting around an axle. The stable form of this type of arc is known commonly as the cone spiral.

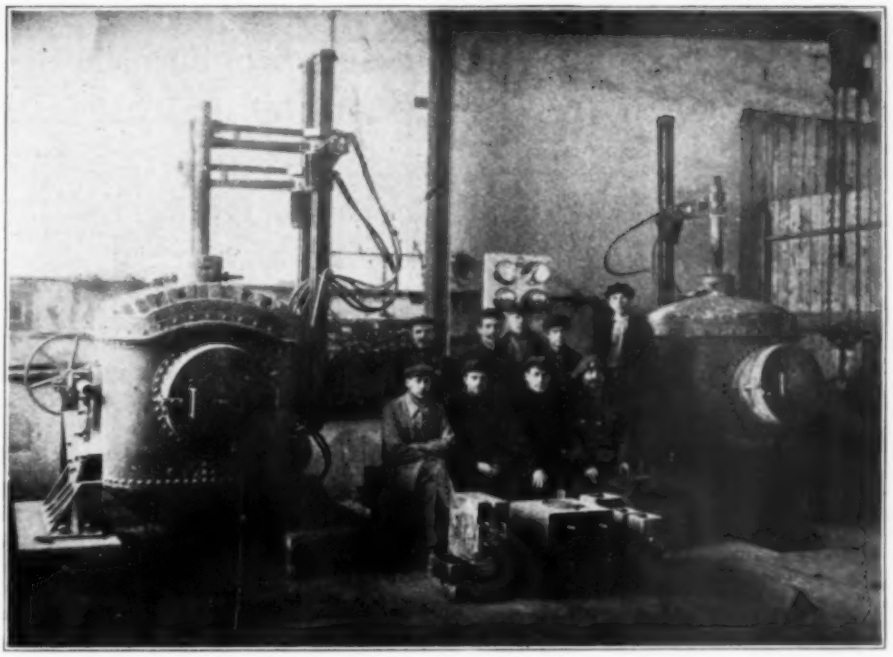


FIG. 5—VIEW OF THE SINGLE AND DOUBLE ELECTRODE FURNACES AND OPERATING CREW. THE FURNACES ARE OF THE TILTING TYPE WITH HAND OPERATED ELECTRODE MECHANISM

Advantages of furnaces using the rotating arc are:

Ready heat convection to the metal and even distribution of heat to the charge. Evenness of melting also is aided by the circulation of the molten metal bath which is caused by the repellent action of the forces produced by the magnetic field set up by the exciting coil.

Stability of the arc which is due to the maintenance of a dynamnic equilibrium rather than a static equilibrium.

Stability of arc permits an increase in the length of arc. Increased length of arc permits the use of higher voltages and their attendant lower currents. This also makes it possible to employ cables and electrodes of smaller cross section.

A furnace employing the principle of the rotating arc was installed first in the Tube Plant Mfg. Co., Ekaterinoslaff, Ukraine, in 1923. The furnace is in operation at the present time and has produced more than 4000 heats of steel. This furnace is small having a capacity from 200 to 250 pounds, but has performed well under unfavorable conditions.

To enable a more thorough study to be made of the arrangement of the furnace and the possibilities of wider application of this type of furnace, in the United States of the Soviet Republic, a license was granted to the State Electrical trust. In January 1926, two furnaces were installed in Kharcoff for experimental purposes. One of the furnaces is basic lined

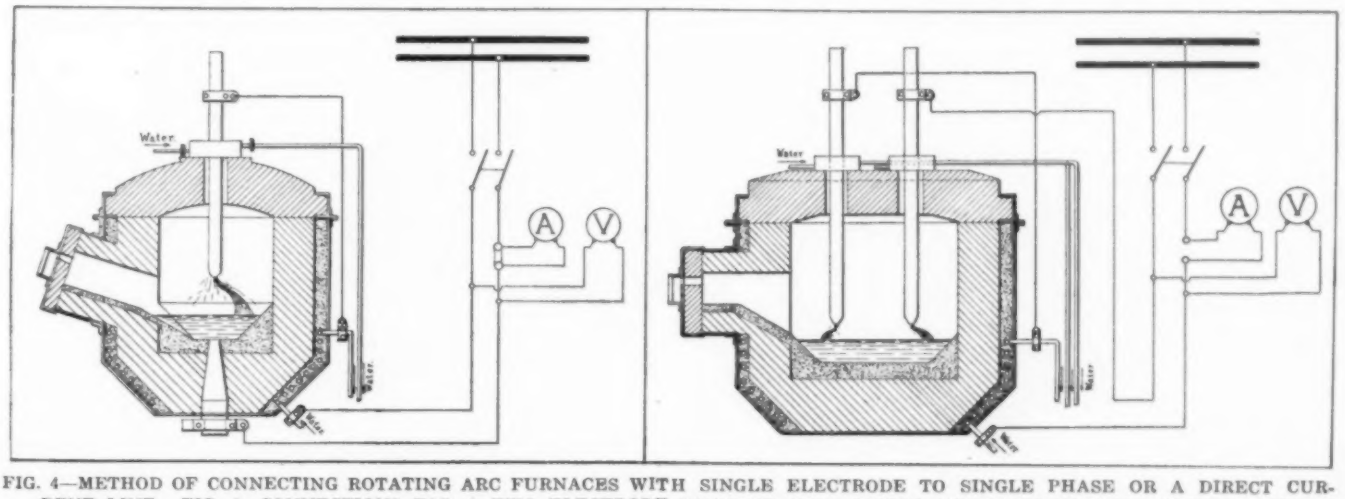


FIG. 4—METHOD OF CONNECTING ROTATING ARC FURNACES WITH SINGLE ELECTRODE TO SINGLE PHASE OR A DIRECT CURRENT LINE. FIG. 6—CONNECTIONS FOR A TWO ELECTRODE FURNACE IN A SINGLE PHASE OR DIRECT CURRENT LINE

Operating Data on Rotating Arc Furnace

Lining	Weight of Charge Kg.	Time for Melt. Down Min.	Power Cons. in Melt. Down Kwh/t	Voltage Before Melt. Down	Voltage After Melting Down	Current Before Melting Down	Current After Melting Down	Duration of Heat Hr. Min.	Total Power Consp. Kwh/t	Type of Heat
Without bottom electrode Acid	250	33	374	220–250	180	800	900	1 20	621	Mild cast.
	250	30	433	222–270	160	770	1000	1 35	672	Mild cast. High carb. Steel
With bottom electrode Basic	180	45		180–220	120	500	850	1 10	980	Mang. Steel Castings
	140	35		120–140	140	500	800	46	780	

and the other is acid lined. These have capacities of 350-450 pounds and 450-650 pounds respectively. Methods of connecting the furnaces in the line are shown in Figs. 4 and 6, and views of the furnaces are shown in Figs. 5, 7 and 8.

Both furnaces are connected to a 3-phase circuit of 3150 volts through a motor-generator set which produces 300 volts direct current. Direct current was used to determine the most effective voltage. One furnace has operated with the same stability on alternating current and the second furnace will operate better with alternating current than with direct current. Operating data for the furnaces are given in the accompanying table.

Many advantages are obtained by using the rotating arc, but the writer believes that the main advantage lies in the stability of the arc. Many heats have been melted by the writer without any breaking of the arc although the feeding mechanism is hand operated. Of course, much depends on the manner of charging, attendance and skill of the personnel.

When the arc is struck, it is fluctuating, noisy and breaks off. After forming a large pool of metal, it becomes quiet. When the metal is melted down and the furnace hot enough, the electrical measuring instruments are the only evidences of the furnace operation because the process is so noiseless and the furnace sealed so hermetically. Length

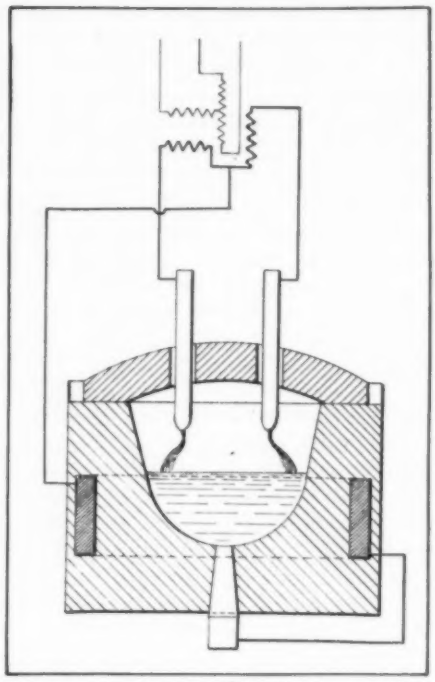


FIG. 9—SCOTT CONNECTION FOR A TWO ELECTRODE FURNACE USED IN A 3-PHASE ELECTRIC SYSTEM

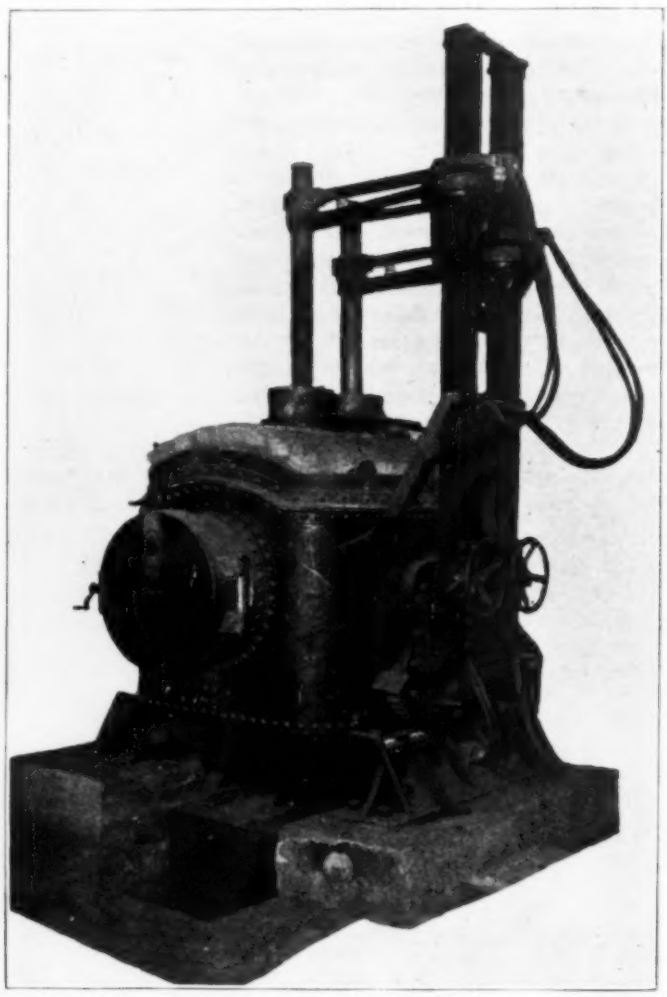


FIG. 7—SINGLE ELECTRODE FURNACE WITH BOTTOM ELECTRODE. ELECTRODE ADJUSTMENT IS MADE BY A CHAIN ARRANGEMENT IN THE VERTICAL SUPPORTING COLUMN. FIG. 8—TWO ELECTRODE FURNACE WITH BOTTOM ELECTRODE

of the arc is mainly 150 to 200 millimeters (5.9 to 7.9 inches) though the writer often has worked with arcs of 300 millimeters (11.8 inches) and even has obtained arcs as long as 500 to 600 millimeters (19.7 to 23.6 inches). An arc of this length is exceedingly hard on the roofs and walls of the furnace. The commonly used 200 millimeter arc is shown in the illustration at the head of this article.

Melting loss is dependent on the grade and character of materials charged and on the method of charging. It runs from 0.5 to 8.0 per cent. Electrode consumption for American and Austrian graphite electrodes is from 0.3 to 0.5 per cent of the weight of metal charged and for German carbon electrodes the consumption is 0.75 to 1.25 per cent.

The construction of the furnace is simple and consists of a shell constructed of extra heavy boiler plate reinforced with structural shapes. The shell is mounted on heavy rockers for tilting and the tilting mechanism consists of a ball bearing thrust, hand or motor controlled, which tilts the furnace back or forward to facilitate tapping, rabbling, slagging and charging.

Electrode holders are mounted on one side of the furnace and are rigidly constructed to prevent electrode breakage. The holders are supported by cross heads which are moved vertically on the columns by a chain. Doors and roof glands are close-fitting and the escape of furnace gases is reduced to a minimum.

Fig. 11 shows the exciting coil which consists of a water-cooled copper tube or snake. When direct current is used the coil may be connected either in series or parallel. In case of alternating current the coil must be connected so that the arc current and the coil current are approximately the same phase, otherwise the arc instead of rotating in one direction will twist in one side and out the other. A 2-phase furnace may be connected to a 3-phase line either by the Scott connection shown in Fig. 9 or by a 3-phase transformer in a Taylor connection shown in Fig. 10. Consequently, 2-phase furnaces of 1000 pounds capacity now are to be built at Ekaterinoslaff and at Makeevka.

Book Review

Fachworterbuch fur das Giesserciwesen, 60 pages, cloth. 4¼ x 6 inches, published by the Verein Deutscher Eisengiessereien Giessereiverband, Dusseldorf, Germany, and may be obtained only through the association's office at Breit-str., 29, Dusseldorf, price 3 M, or $0.75.

As the title indicates, this is a dictionary of foundry terms. It was published primarily for the benefit of the German delegation who visited the Detroit convention of the American Foundrymen's association and contains both German-English and English-German sections. This short dictionary will be found extremely useful to English-speaking people who may desire to visit German foundries or to review literature on the subject as well as to the German-speaking people reading foundry literature of this country. The word to be defined is set in bold face type which aids considerably in reference.

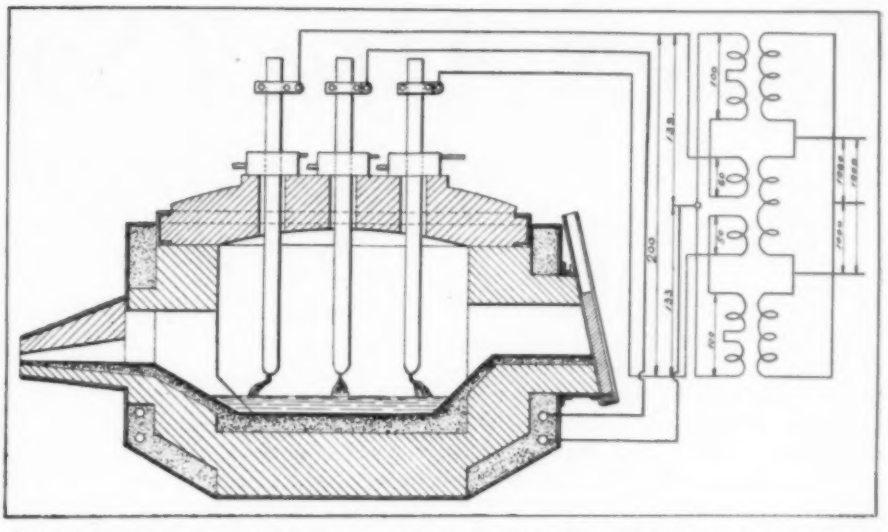


FIG. 10—SCHEME OF CONNECTING A 2-PHASE ELECTRIC FURNACE IN A 3-PHASE LINE BY USING THE TAYLOR CONNECTION

Booklet on Labor Payment

An analysis of the group bonus labor payment plan has been published by Ernst & Ernst, New York, in a 32-page booklet. Experiences of a number of manufacturers with this system of payment is summarized with the details of the plan. The text is confined to the simple essentials of adequate and dependable information arising from successful experience.

Electric Controller & Mfg. Co., Cleveland, has appointed the Farr Electric Service Inc., Salt Lake City, Utah, as its representative.

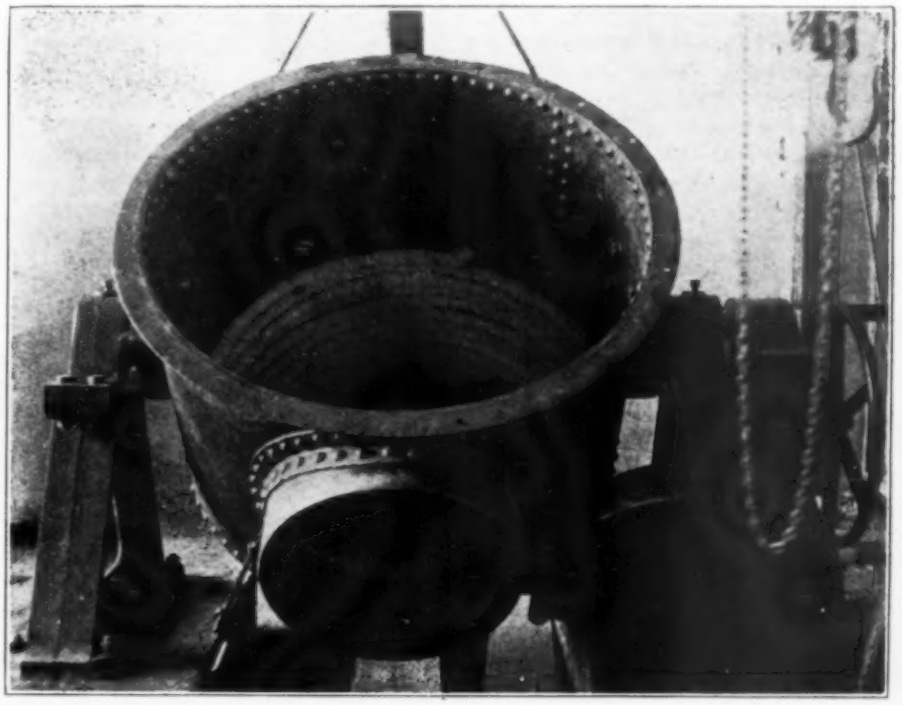


FIG. 11—SHELL OF FURNACE SHOWING THE POSITION OF THE EXCITING COIL. THIS COIL IS COMPOSED OF A HOLLOW COPPER TUBE WHICH IS WATER-COOLED

Gases Affect Soundness of Castings-II

By E. Longden

A PART section of a sleeve casting, which is to be machined all over is shown in Fig. 11. Defects occur about the place where a portion of the mold protrudes into the metal. Such a piece of sand quickly reaches a high temperature and acts as a heat retainer. The grains of sand expand and loosen somewhat, allowing a freer passage for the imprisoned gases in the body of the mold. Unless an easy and clear vent is provided, the gases will flow into and be found in those places last to freeze, as indicated in the sketch. A densener placed on the bore opposite the unsound place hastens cooling of the metal, thereby reducing the time that the gases can generate and flow from the sand.

Another common defect is shown in Fig. 13. Namely porosity about cylinder ports. The thin cores act as heat retainers. If such cores and the lightening core between the ports is not vented freely, defects as indicated may be expected. A number of small, clean nails pushed into the mold or cores about the vital spot generally eliminates such a trouble. Fig. 14, showing a portion of a diesel cylinder head, illustrates a similar case.

Sponginess in pulley bosses may be eradicated by removing the core and placing denseners at both the top and the bottom, as depicted in Fig. 15. The size of the densener always should be 1-inch less than the diameter of the boss. Not only is the cavity removed but the rate of cooling is equalized and the danger of fractured castings minimized by this means.

Shrinkage holes in heavy feeding heads with a core running through the center show up as in Fig. 16. The cavity is disclosed on the core side as well as in the center of the head section. The core becomes porous and over heated at this part, allowing gases to flow freely into the metal, which possibly reacts with gases being occluded by the metal.

Fig. 17 shows a section often encountered in cylinders, etc. A cavity is found at the root of the boss. A number of small clean nails inserted in the mold so that they do not protrude into the machined portion will overcome this trouble.

In the fork-like casting shown in Fig. 18, a comparison between gray and white iron may be made. The section *A* shows the position of the cavity when cast in gray or white iron. In gray iron, the defect disappeared when a densener was applied as indicated in the sketch *C*. In white iron the densener proved useless. A sound casting was obtained by enlarging the section above the trouble spot and providing a self-feeding head as shown at *B*.

Fig. 19 represents a double pinion blank cast in white iron. Here the combination of denseners applied to the blank cast bottom with two good feeding heads is necessary to secure a good casting. Fig. 20 shows a section commonly encountered both in gray and white iron. The gases accumulate in the hot spot. Denseners placed in the corners will remove the defect.

An L-shaped casting is illustrated in Fig. 21. The casting is of white iron, and weighs about 504 pounds. If denseners are not applied to the heavy-section corners, together with good feeding heads, unsoundness and weakness may be expected.

Fig. 22 illustrates a die casting about 896 pounds. Cast in the ordinary way in a loam or sand mold, porosity occurs as shown in the section *AA*. To remedy this defect denseners were introduced with 1-inch of sand dividing them. After machining hair cracks were disclosed opposite the places which corresponded to the sand between the denseners. This further com-

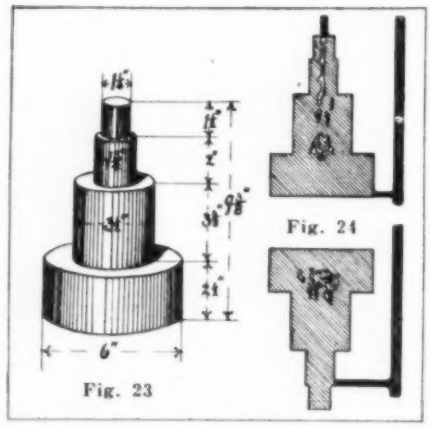
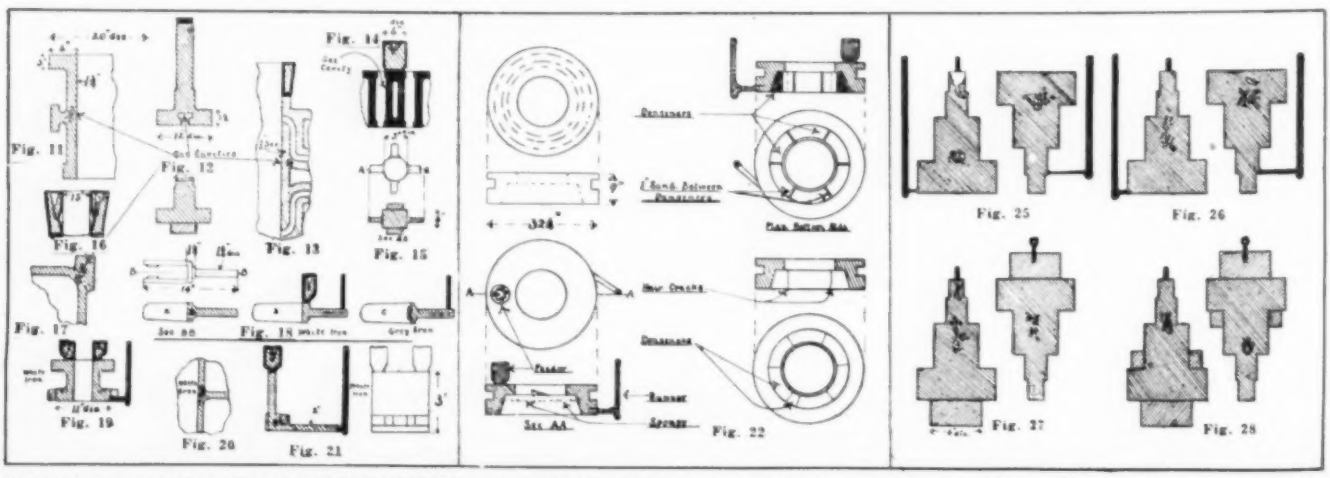
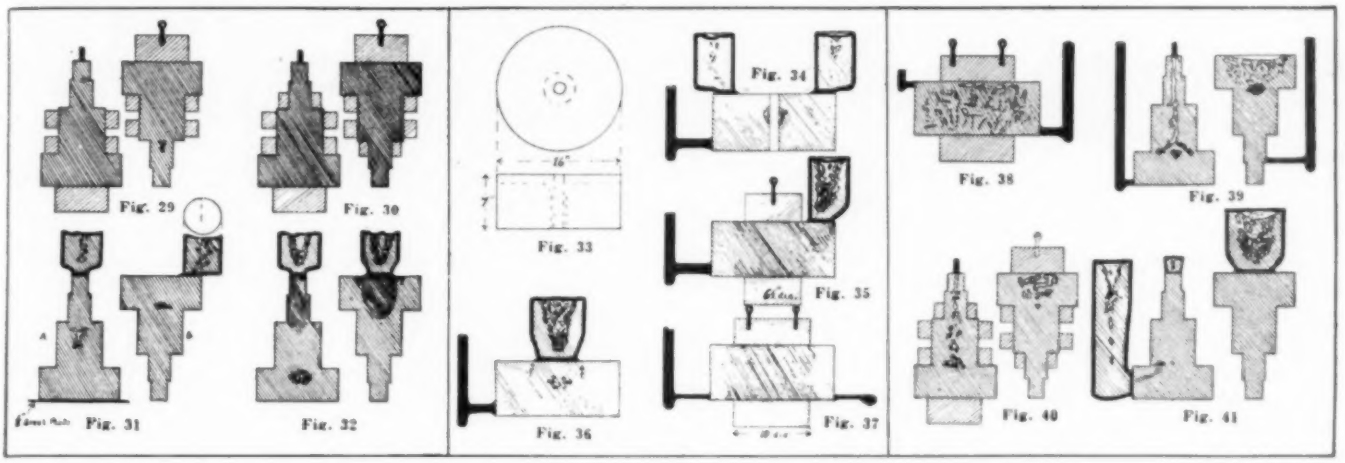


FIG. 23—DETAILS OF DESIGN SELECTED.
FIG. 24—TEST BLOCKS WERE POURED IN THESE TWO POSITIONS



FIGS. 11 TO 22 AND 25 TO 28—CROSS SECTIONS OF VARIOUS TYPES OF CASTINGS SHOWING POROSITY IN DIFFERENT SPOTS



FIGS. 29 TO 32—SHOWING THE VARIOUS POSITIONS IN WHICH THE BLOCK WAS POURED. FIGS. 33 TO 41—DIFFERENT SHAPED BLOCKS AND KINDS OF IRON WERE USED TO SEE THE EFFECTS ON POROSITY

plication was overcome when denseners were continued over the whole surface.

Some time ago the author carried out a number of experiments on block castings designed to give the maximum gas or liquid shrinkage cavity to discover the cause and the best way to eliminate the defects found. These experiments first will be explained briefly and then supplemented with recent experiments along the same lines.

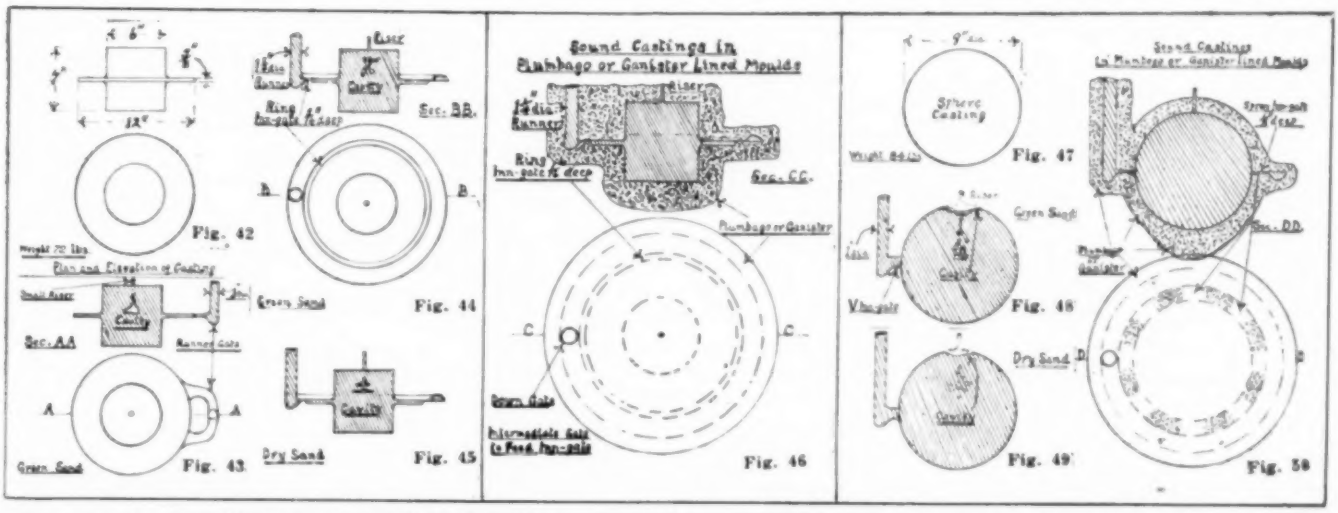
Fig. 23 shows the design first selected. The casting weighs 28 pounds. With one or two exceptions the blocks were poured in two positions for each test as indicated in Fig. 24. The molds were made in green sand, bottom poured, and all ordinary precautions were exercised to secure a good casting. However, no effort was made to feed. The result at once opened up an interesting field for further experiments. With the block cast small end up complete evidence of gas streams were found. Two blocks poured through ¼-inch pencil gates, as in Fig. 25 show a slight reduction in the extent of the cavities. The two blocks in Fig. 26 were poured in thoroughly dried molds. The cavity compared favorably with those poured through pencil gates. Figs. 27 to 30 show the progressive application of denseners which resulted in a perfectly sound casting. To exclude mold gases from the bottom side, a ⅛-inch iron plate was inserted in the mold, as shown in Fig. 31. A feeding head the same size as the small end was carried through the mold and a basin of metal provided as a self-feeder. Defects were not so pronounced as in the first test.

A semicircular self-feeder was applied to the next block poured, as shown at *B* in Fig. 31. Only a small defect was found, showing that the heavy feeder had maintained a hot passage for the occluded and mold gases to pass out. Fig. 32 illustrates unsoundness with rod feeding.

At this stage the author came to the conclusion that a sound casting might be obtained if mold gases could be prevented from passing into the metal. Molds were constructed in plumbago, bound together with a small proportion of core gum, thoroughly dried and gated in the same manner as the earlier attempts. Perfectly solid

Data from Chemical and Physical Tests

Analysis	Per cent	Mold material	Tensile tons sq. in.	Transverse 3′ x 2″ x 1′	Deflection
Total Carbon	3.11	Green			
Graphitic carbon	2.86	Sand	10	25.2	0.37
Combined carbon	0.25	Dry			
Silicon	3.20	Sand	10	24.8	0.38
Phosphorus	1.38				
Manganese	0.36	Plumbago	9.6	24	0.39
Sulphur	0.09				
Total impurities	8.14	Ganister	10.2	25.4	0.38



FIGS. 42 TO 50—FURTHER EXPERIMENTAL CASTINGS WERE POURED. IN THE CASE OF THOSE MADE IN PLUMBAGO OR GANISTER LINED MOLDS, NO POROSITY WAS EVIDENT

castings resulted. Well-dried ganister molds also gave sound castings with a much closer grain.

Fig. 33 illustrates another experimental block casting weighing about 364 pounds. The first castings produced had a sand-cored hole through the center. They were bottom poured with two heavy self-feeders located as shown in Fig. 34. A large cavity was formed about the center core. A similar cavity was found when the central hole was formed by an iron core. A block cast without core, riser or feeder gave a larger cavity. Fig. 36 shows a casting fed through a 6-inch riser, but this again was defective.

A passable casting was secured by applying 6-inch denseners to the center of the mold, one top and one bottom, and feeding head situated as shown in Fig. 35. Fig. 37 shows the same casting poured through several bottom spray runners without any riser or feeder. Two denseners, 10 inches in diameter were placed in the center of the mold, top and bottom. A perfectly sound, close-grained casting resulted.

Pour Into Plumbago Molds

Fortified by the experience gained from the smaller blocks, one of these heavy castings was poured in a plumbago mold without riser or feeder and a casting free from defects was secured. A mold made in ganister gave a thoroughly sound casting.

Fig. 38 represents a block of white iron, which shows a striking contrast with those made in gray iron. Blocks similar to Fig. 23 made in green sand molds and not fed, were poured in white iron, and disclosed, as would be expected, much cavity, as illustrated in Fig. 39.

The four sets of denseners, which had proved so effective when applied to the blocks poured in gray iron, did not make any noticebale improvement with white iron. As will be noted in Fig. 40, the defects are almost as extensive as those made in green sand.

Fig. 41 illustrates two attempts to obtain a sound casting. The block cast small end up required a large feeder to secure small cavities only. Pouring the casting large end up, with a 3-inch riser-gate and a self-feeding head, resulted in a sound casting.

Fig. 42 illustrates design of another experimental casting chosen which weighed 72 pounds. Fig. 43 shows a cross section of the first casting made in the ordinary way without feeding, only a small relief riser being provided on the boss. As would be expected considerable cavity was disclosed. Fig. 44 depicts the cavity which formed when made in a green sand mold and poured through a thin gate, 1/16-inch deep, completely encircling the 12-inch diameter plate which surrounds the boss. It will be noted that the cavity is not so great. It was not poured slowly because the inlet gate although thin was equal to an area of 2.36 square inches. The greater soundness could be attributed partly to the sieving of the metal when passing through the thin runner. Fig. 45 shows the cavity resulting from a dry sand mold but is less than the one cast in green sand. Fig. 46 shows the next two castings which were poured in ganister and plumbago molds respectively. Absolute soundness was obtained.

The next test was made on a 9-inch diameter sphere weighing about 84 pounds, as presented in Fig. 47. Considerable cavity was disclosed when poured as shown in Fig. 48. Fig. 49 shows slightly less cavity when poured in dry sand. Fig. 50 gives particulars of the next two castings made which were poured into thoroughly dried ganister and plumbago molds respecitvely. Again no castings were free absolutely from defects.

A comparatively poor metal was used purposely to obtain the worst results. Physical and chemical tests of the metal poured into the experimental castings were obtained and are given in the accompanying table.

Four transverse and four tensile bars were made in green sand, dry sand, plumbago and ganister molds respectively, and ample space was allowed between each bar when molding. The four transverse bars were poured together in one box and the tensile bars together in another box. This insured that the bars would be poured with exactly the same metal and at the same temperature.

Invite Foreign Firms to French Convention

Plans are announced for an exposition and convention devoted to the foundry industry to be held in Paris, France, during the month of September, 1927. While this gathering, which is being organized by the General Syndicate of French Foundrymen it will be patronized largely by French foundry and manufacturing interests, an invitation will be extended to interested societies and individuals in other countries. C. Dufour, president of the General Syndicate of French Foundrymen, is in charge.

Book Review

Foundry Sand; by Eugene W. Smith; cloth; 190 pages 5½ x 7½ inches; published by the author and may be ordered through THE FOUNDRY for $5.00.

This attractively bound book covers a far wider range even than is indicated by the full title *Foundry Sand Its Uses and Abuses.* Eugene W. Smith, general foundry superintendent the Crane Co., Chicago has investigated every phase of the sand question for a period of many years. As a result of his observations he developed what is known as the vibratory test, a simple method of determining the relative quantities of sand grains and bonding material in any given sample of sand.

The author bluntly states in the beginning that the book is not merely a compilation of results of laboratory experiments, but deals with ordinary foundry problems in ordinary foundry language. It is written in what has come to be recognized and accepted as popular magazine and newspaper style, short chapters and short paragraphs, usually one sentence to a paragraph. For example the first 100 pages are covered under almost as many chapter headings, dealing among other things with a description of the vibratory test and how the results may be interpreted when taken in connection with the scrap heap and the condition of the castings. Typical sources of trouble caused by sand are described and the obvious remedies are suggested. An exceptionally illuminating chapter is devoted to gates, how their shape, size, position and number affect the castings.

Descriptions of sand specimens from practically every state in the union occupy the second half of the book. Each description carries the name of the state, the particular deposit from which the sample was taken, the color, the purpose for which the sand particularly is adapted and the amount of bond and silica as determined by the vibratory test. The book should find a free and ready acceptance among foundrymen who want essential facts boiled down and ready to serve.

Receives Appointment

Burton L. Delack, formerly assistant manager, Erie, Pa., works of the General Electric Co., has been appointed assistant manager of the Schenectady, N. Y., works. John St. Lawrence, formerly general superintendent at Erie will succeed Mr. Delack there.

Reviews American

Steel Foundry Industry

Names Some of the Pioneers of Steel Founding—
Use of Green Sand Molding Solves Problems

Part I

By R. A. Bull

IT IS a pleasant pastime for some who trace their ancestry back to the days when pirates were regarded as gentlemen, and when conduct was not so much a matter of ethics as of expediency, to patronizingly decry America's lack of seasoned culture. It seems to be an equally agreeable occupation for some who consider themselves as solely responsible for their present comfortable stations in life, to proclaim the fact that they are self-made. The members of the aristocracy often undervalue the priceless virility behind a single generation's achievements, while the newly rich frequently fail to appreciate the wholesome maturity resulting from the training of former generations.

The story of steel in the United States is a striking illustration of the fact that ours is a young nation, and of the more important fact that America's development has been due largely to the driving stimulus that characterizes immaturity. That is true with respect to industry as to the arts and letters; and the manufacture of steel presents no exception. Only within the last few years have Robert W. Hunt and Joseph S. Seaman gone to that final resting place which we may hope is reserved for the pioneers who made important contributions to our economic progress, in manufacturing steel products.

Turns Rail Rolls

Many now actively engaged in industry enjoyed personal acquaintance with each of these men; the one, Captain Hunt, having to his credit the rolling of the first steel rails made commercially in the United States; the other "Daddy" Seaman who later became a prominent and particularly beloved foundryman, sharing the honors due Captain Hunt through having turned the rolls employed for making the original steel rails in 1867. The metal was produced in this country in a bessemer converter almost coincidentally with the perfection in Europe of the open-hearth furnace.

The year that marked the beginning of steel rail manufacture in America has another important event to make it industrially significant. Probably the original steel castings made in the United States were then produced in what was known as the William Butcher Steel Works, which later came under the control of the Midvale organization. Among the first steel castings made at the Butcher foundry were crossing frogs for the Philadelphia and Reading railroad. It is claimed that these castings were so satisfactory that some of them were in use for 27 years, or until 1894.

Unfortunately in the steel, as in other industries, those who accomplish most are not inclined generally to leave behind them comprehensive chronicles of their achievements. The story of the life of many a man who materially helped promote progress in an important branch of science, engineering or industry would provide a record of great interest.

Illustrations are found often in the historical references to the making and casting of metals. Achievements of Reaumur, Huntsman, Boyden, Bessemer, Siemens, and others who have joined their fathers, have left for us not only inspiring records of metallurgical significance, but transcripts of events having much human interest even for those who, because of detachment from the activities directly or indirectly related to mill or foundry, might imagine a recalescence point to be some kind of sharp instrument; or the drag of a flask to be a phrase indicative of present-day habits. The steel foundry has had its pioneers whose experiences are of interest from many standpoints to the uninitiated as well as to the initiated.

Fail To Record Events

Few of them have left chronicles of their activities. It is regrettable that oldtimers now deceased, like Wharton, Johnson, Taylor, Eagan, Gallagher, Harrison, Deutcher, George H. Smith, and others, were not generally of the type likely to sit down quietly in their placid days of ripened retrospection and record for those of a younger generation the events associated with the beginnings of the steel foundry industry in the United States.

Created sixty years ago, it has had a highly interesting development, largely dependent on concurrent progress in several industries, and essentially contributory to advancement in

Knows Steel Foundry

DUE to his long connection with the steel foundry industry, the author of this paper qualifies to comment on its past developments, its present tendencies and its future possibilities. This article, which is from a paper presented at the Detroit convention of the American Foundrymen's association, Sept. 27 to Oct. 1, will be published in three sections.

Robert Alexander Bull, the author, was born at New Albany, Ind., on June 28, 1874. He was graduated from Butler college, Indianapolis and received his master of arts degree at St. Louis university, St. Louis. From 1893 to 1920 Mr. Bull was connected in various capacities with the Robert W. Hunt & Co., the United States Cast Iron Pipe & Foundry Co., Strickle, Harrison & Howard Iron Co., Leighton & Howard Steel Co., American Steel Foundries Co., Chicago Steel Foundry Co., Dequesne Steel Foundry Co., and the United States Army ordnance department, American Expeditionary forces. He has been research director for the Electric Steel Foundries Research group since 1920.

R. A. Bull

Mr. Bull has contributed numerous articles on steel casting and steel founding to the technical press and is co-author of the A B C of Iron and Steel. He is a member of the American Foundrymen's association, American Iron and Steel institute, American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials, Institute of British Foundrymen and several other organizations.

many. Many individuals are living, who have made during long careers, numerous important contributions to one or more phases of the steel foundry industry, either through themselves or through the organization headed by them. Among these men are John Maher, W. D. Sargent, J. C. Davis, I. W. Frank, C. C. Smith, S. P. Bush, W. H. Worrilow, F. G. Wright, and C. H. Howard. Some of these men are well qualified to describe important facts concerning the industry's advancement. Generally, such individuals get much more satisfaction from doing things than from writing about them.

The writer wishes not to become tiresomely reminiscent in speaking of the earlier days of the industry. He believes even a brief analysis of the development of any mechanical process or combination of processes lacks an appropriate feature if shorn of references to individuals who have made important contributions to its progress. It logically has been claimed that the future of an industry cannot be forecast reasonably without the most intelligent analysis not only of present conditions but of circumstances that have been factors in creating and maintaining the existing situation. The purpose then in referring to the earlier days and to the individuals who were prominent in the industry during significant periods of growth is to establish such relationships as may be helpful for intelligent consideration of present and prospective conditions.

Progress During the 19th Century

History of the steel foundry industry in America for the first 20 years of its existence is not now of particular interest. Many of our manufacturing operations were then in a state of flux. Steel founders were cautiously feeling their way. The nation had not yet become an economic giant. Developments in the manufacture and distribution of steel castings were more or less sporadic until about 1887, when the successful production of steel rolls and certain castings for ordnance use directed the attention of many who foresaw the application of the product of the steel foundry to a large variety of uses. Before the last decade of the nineteenth century, the industry reached the adolescent stage and became an important factor in our country's economic development.

In the interesting period now facetiously termed the *gay nineties*, steel casting manufacture made an important advance step by the successful adaptation of green sand molding. Looking back and considering the striking effect this development had on the industry, it seems peculiar that information regarding green sand molding in the steel foundry was somewhat slow in coming to the notice of those in the technical world who betrayed interest in, while not associated with, steel casting manufacture. In 1909 the writer clipped from a technical journal that was then and is now well known, an article in which a consulting engineer of high reputation stated: "For steel castings the molds * * * must be thoroughly dried before the hot metal is poured in them * * *. To pour the hot steel in molds filled with green sand that has not been dried out would cause the gases to form so suddenly that they would cause an explosion."

Solves Problem of Shrinkage

Pioneers in the middle western states were largely responsible for the development to which we are referring. Probably it was the principal factor in the rapid adaptation of cast steel to railway use, which was to become extensive and permanent. Green sand molding did much to solve the problem of shrinkage, which had been an extremely troublesome factor in producing many castings, the designs of which presented difficulties with respect to the contraction of cast steel during solidification, excessive as compared with that of other ferrous metals. The result was among the most important epochs in the industry's development, through the establishment in the last few years of the nineteenth century, of large open-hearth shops for the specialized production of railway steel castings. There was economic justification for the erection of these foundries, the most of which, and particularly the combined capacity of which, increased greatly during the period we are considering. In many respects, the 10-year interval beginning with 1895 can be regarded as of the highest importance in plant development for steel casting production. An innovation that was applied at this time with great advantage to many steel foundries was the use of fuel oil in open-hearth furnaces. This eliminated certain difficulties from red-shortness caused by sulphur from inferior coal used for producing gas. Other advantages were derived from the liquid fuel which have been of material benefit in many foundries.

Most of the railway specialty shops from the beginning adopted the basic lining for their furnaces, primarily because of the cheaper operating cost as compared with the expense of making acid steel, which continued to be favored among the eastern foundries, where the product consisted, to greater extent than in the West, of castings requiring extensive machining before application.

In the nineties and at the beginning of the present century, there were restricted opportunities afforded the steel maker for satisfactorily deoxidizing his metal. The result was a relatively large percentage of steel castings containing blow-holes, particularly in the product of the basic furnace, where the oxidation process is necessarily prolonged as compared with the operation of acid lined furnaces. For some time the only alloy given the name of ferrosilicon which was commercially available, was one containing usually from 12 to 13 per cent silicon.

Carborundum or carbide of silicon was used extensively as a supplementary deoxidizer. It contained approximately 60 per cent silicon, 35 per cent carbon, 1.5 per cent iron, and 1.5 per cent aluminum. Restricted opportunities for uncontaminated deoxidation naturally resulted in too great dependence on aluminum, which was introduced frequently in proportions that materially reduced the shock resistance of steel castings.

Ductility Was Low

Relatively poor ductility generally characterized steel as produced for castings at the beginning of the twentieth century. The writer has records of the performance of a basic open-hearth foundry that in 1900 was regarded well, and produced common steel averaging 0.28 per cent carbon, which, after a normalizing treatment, showed usually a tensile strength of 70,000 pounds and an elongation in 2 inches averaging 8 per cent. Such metal would not be acceptable today for most purposes employing cast steel.

Ductility values typical of acid open-hearth steel made at the close of the nineteenth century generally were higher by a small margin than those obtained in basic practice, but were far below the figures prescribed today. At that time, when steps were being taken to organize the American Society for Testing Materials, specifications for steel castings usually did not include requirements for reduction of area. The percentage of elongation was regarded by most engineers as sufficient indication of ductility. Engineering handbooks and copies of specifications published 30 years ago show a prescribed minimum tensile strength of 60,000 pounds and a required percentage of elonga-

tion which did not exceed 15 per cent and in many cases was low as 10 per cent. Values for yield point and reduction of area were not prescribed.

Progress of the industry during a quarter-century of development may be gaged to some extent by a comparison of the requirements just mentioned with those prevailing today, which provide for soft steel castings averaging, at least 60,000 pounds tensile strength, an elongation of not less than 24 per cent, and a reduction of area of at least 35 per cent.

Knowledge of Heat Treatment

Melters in charge of steel furnaces at the beginning of the present century and for some years thereafter were not responsible for all of the relatively poor showings of tension test pieces, most of which met the easy requirements of earlier specifications. There was deficient knowledge of heat treatment, by which term now generally meant is normalizing, annealing, or any other application of heat, single or repeated, for producing structural refinement. Inadequate attention was given to the accurate machining of test specimens, properly regarded today as a highly important factor. Tool marks on the finished throats of tensile test pieces were seen frequently, and often escaped criticism.

It would be impossible to estimate intelligently what the tensile properties of cast steel, as customarily made a quarter-century ago, would have been, if skilfully heat-treated and tested. Associates of the melter in the laboratory had much to learn regarding the procedures for developing by heat treatment and latent properties of the steel, and for evaluating the material by means of properly tested specimens.

Irrespective of the responsibility for comparatively poor results, it was ultimately recognized by intelligent consumers that they had not, during practically three decades, been supplied with steel castings whose homogeneity had ductility conferred on the product, qualities making it sufficiently dependable under severe service conditions. Realization of the necessity for improvement at the time referred to, did not place steel castings in a conspicuously unsatisfactory classification as to serviceability.

Practically every kind of iron or steel product was embraced in the all-inclusive category of material capable of being more skilfully manufactured, and of being tested with due regard for the characteristic properties of the product when made right. Steelmakers and users began to cooperate in the analysis of data regarding metal made under different conditions, about the time when the American Society for Testing Materials was chartered in 1902. Thus did the inauguration of standardized testing work give the steel casting industry, like others, an invaluable stimulus that has prevailed without interruption, and will continue.

It has been pointed out that the manufacture of steel castings in the United States reached the important stage of marked specialization in the late nineties, through the erection of plants for producing steel castings in large quantities for railway use. Thus was provided the principal incentive for the construction of basic open-hearth foundries. Special equipment was installed about the same time in numerous shops to be largely devoted to the production of steel rolls and other large steel castings for mill use. Manufacture of rolls inevitably led to experiments with alloys, resulting during the next 10 years in the development of important combinations of the elements for this purpose.

Crucible Steel Foundries

The crucible furnace, since 1899 the least important tonnage division of the industry, has maintained its production with reasonable regularity, considering the important developments with respect to other melting units. Early records showing steel casting production which are considered reliable, do not extend beyond 1898. In that year the tonnage of crucible steel castings exceeded the output of the production from the converter, and was more than 4000 tons. Ten years later it had practically doubled. The peak was reached in 1912, when slightly more than 20,000 tons were produced.

Marked increase in the demand for small steel castings which assumed a significant aspect about 1905, had its effect on crucible steel foundry production. By 1917 the tonnage of crucible steel castings roughly equaled the output 18 years before that time, after a fairly steady decline that began in 1913 and resulted in the low output of 736 gross tons in 1921. Last year the tonnage of crucible steel castings was reported as 1833, or less than 10 per cent of the production 14 years before, when the peak for this branch of the industry was attained.

Statistics show that a relatively small volume of steel castings has been produced in the crucible furnace. The size of the vessel militated greatly against its extensive application. The cost and short life of the crucible presented serious handicaps. The converter, despite its high melting loss, including the cupola, of approximately 15 per cent, proved to be a less expensive operating unit than was the crucible furnace. Important features of the converter were its fair-sized capacity, and frequent delivery of the finished metal. This vessel has never had an equal from the standpoint of supplying the molding floor with steel in moderate or large quantities at a rate approaching continuous performance.

Converter Steel Foundries

A significant development began about 1905, through the adaptation of the bessemer converter to the production of small steel castings, previously made in relatively low tonnages. The principal inventor responsible for the modification of the converter was Tropenas, whose experiments in Europe in 1890, in blowing the metal above its surface met with success. The converter, modified as to size and partially as to operation, proved one of the most useful devices developed for making steel castings. It solved satisfactorily the problem of high temperature, which had been a difficult one for open-hearth foundries producing heats usually ranging from 15 to 25 tons, limited as to practicability of high temperatures by the life of refractories, and by construction details that necessitated long periods of shutdown for renewing refractories.

Ultimately the applicability of the open-hearth furnace to small steel casting manufacture was aided by the construction of melting units having a capacity as low as 5 tons, and having regenerative chambers and stacks liberally proportioned to facilitate the utilization of higher temperatures than were typical of open-hearth furnaces of customary foundry sizes. However, the open-hearth furnace in its essential details was recognized from several standpoints as poorly adapted to the specialized production of small steel castings. The converter took its temporarily commanding position in the industry for that purpose and maintained it until the development of the electric furnace.

Temperatures attained in the converter provided metal sufficiently fluid to run the smallest sections preferred by designers of small parts. Shops employing this melting medium, while in a fortunate condition with regard to the specialized production of small steel castings, found themselves handicapped by high metal cost in competition against open-hearth foundries, when producing castings of

heavy weight or large sections. In this, as in all other similar cases, the melting medium occasionally was used for work to which it was not adapted economically. It began to be apparent that the industry by the nature of the product, would divide itself eventually into two sections.

At times there has been a disposition to minimize the distinct separation of the industry, according to the production of large and small steel castings. Confusion has resulted from the occasional, uneconomical adaptation of fairly large open-hearth furnaces to the manufacture of small castings; and the intermittent, costly use of converters and electric furnaces of small capacity, in the production of large castings. The foundry industry satisfactorily splits itself into the two divisions according to the melting equipment utilized by the foundry, irrespective of the proportions of castings wisely or unwisely made.

During the first decade of the present century, the manufacture of small steel castings by the aid of the converter made many inroads on the business previously enjoyed by malleable iron founders; and by the development of new uses for steel castings where the strength of the material was an important factor in connection with preferred lightness of section. Many of these new uses were such as to require, for the sake of appearance, surfaces much smoother and freer from blemishes than were required on castings of moderate and large sizes. This naturally resulted in the specialized development of cleaning equipment for small steel castings. Thus did the ingenuity of the mechanical engineer follow that displayed by the metallurgist. That vital relationship has prevailed.

Successful production of converter steel castings inaugurated applications of the product in a great many important industries. The converter proved itself to be, when properly regarded, not a competitor of the open-hearth furnace, but an important auxiliary to it for steel casting production. The annual output of converter steel castings increased from less than 4000 gross tons per year in 1899 to more than 22,000 tons in 1905. By 1910 the tonnage of converter steel castings had grown to a figure slightly under 60,000 tons; and the peak of converter steel casting production was attained in 1918, when more than 160,000 tons were credited to this branch of the industry. A reduction in output then began, due to the increased popularity of the electric furnace in the foundry industry.

Shrink Holes in Casting Due To Hot Shaft

Question: We shall appreciate your advice on how to make a solid roller approximately 6 feet long, 11 inches diameter with a steel shaft 3¾-inch diameter extending through the center from end to end. We have tried this job but without success in a skin dried mold in which the runner end was placed about 5 degrees lower than the flow-off end. We had four 2-inch risers on top and fed them with hot iron until they were almost frozen over. At the last instant a considerable amount of iron oozed up through the risers and when the risers were broken off on the following day we discovered an irregular cavity 2 inches deep under each one. We built a special furnace and heated the shaft above a cherry red before it was placed in the mold.

Answer: The best and simplest way to make this casting is on end in a dry sand mold with the upper end carried about 6 inches higher than the indicated top of the castings to act as a sink head and dirt catcher. This extra length easily may be removed in the machine shop after the casting is cleaned. The casting is poured from the top through 12 small pop gates spaced about 2 inches apart on an 8-inch diameter circle. You easily can adapt your present solid pattern by attaching a circular core print 15 inches diameter around the top. Then make a flat, circular core-box to correspond with a plug in the center to correspond to the size of the steel shaft and with 12 small plugs ½ x 1-inch to form the gate openings previously mentioned. After the mold is dried the shaft is lowered into place. The covering core then is slipped down over the shaft and automatically centers it. Suitable straps are clamped across the core to hold it down and the runner is made up either by ramming the sand around a circular block which covers all the openings or by placing a small runner stick in each opening. The first method is the better of the two, but the second is satisfactory in the hands of a skilled molder who takes proper care.

If you have no available equipment for making the casting on end in a dry sand mold, you can make it according to your present method by using larger risers and by feeding them direct with hot metal instead of pouring the metal down an auxiliary runner.

In either case there is no need for heating the shaft red hot. In fact there is no need of heating it beyond the point necessary to insure its absolute dryness. The cold shaft will cause the iron in the center of the casting to solidify first and thus prevent that *draw* that now takes place at the last instant. If you are using cold rolled steel shafting polished bright no coating will be required before it is placed in the mold. However, as a precautionary measure to prevent any moisture from condensing on the surface, you may find it advisable to warm the shaft and then cover it with a light coating of any kind of oil. In the event that the shaft is a rough forging the scale of oxide must be throughly removed before the shaft is placed in the mold. The scale may be removed either by sandblasting or grinding.

The iron you are using is too open if the roll has to present a polished surface. Also we cannot understand why three taps from a 42-inch cupola are needed to fill a 1-ton ladle. Even if the tuyeres are only 10 inches above the bottom, a 42-inch cupola should hold more than enough to fill the ladle at one tap.

Book Review

Story of Steel, by J. Bernard Walker, 208 pages, cloth, 5½ x 8 inches, published by Harper & Bros., New York and supplied by THE FOUNDRY, Cleveland for $3.00, and in London, 2-3 Caxton House, Westminster S. W. 1, for 15s.

A nontechnical description of the steel industry from the mining of the ore to the sale of the finished product, as practised at the mines and the Gary, Ind., plant of the United States Steel Corp. There are two noticeable defects—one that many of the statistical figures are not brought up to date and the other is the poor quality of the illustrations. Aside from these obvious faults, the book presents the story of steel manufacture in logical sequence from the mining of the ore to the finished product with a chapter on selling the product. The author describes the various processes without going into too much detail or the technicalities involved. Readers who desire to know how steel is made and do not desire to wade through the technical phases of the manufacture, will find the book an interesting description of this industry.

A patents room, containing the largest collection of patent files west of the Mississippi, recently has been opened in the Los Angeles public library. These files consist of United States, British, Canadian, German and Cuban records.

TENTATIVE SPECIFICATIONS FOR ALUMINUM BRONZE CASTINGS

(Continued from Data Sheet No. 648)

which they represent. If the castings are heat treated, the coupons representing such castings shall be heat treated similarly.

7. (*a*) Two coupons or test bars shall be cast as an integral part of large castings or cast separately in the case of small castings to represent each lot or melt of 500 pounds or less. Additional coupons may be provided at the option of the manufacturer.

(*b*) The manufacturer and purchaser shall agree whether coupons can be attached

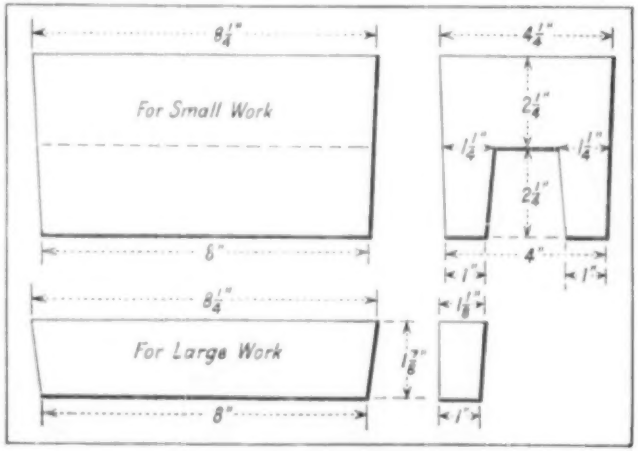


FIG. 2—TEST SPECIMEN COUPON

to the castings, on the location of the coupons on the castings, on the castings to which coupons are to be attached and on the method of casting unattached bars. Unless otherwise agreed upon the minimum lot shall be considered as 500 pounds.

(*c*) If any test specimen shows defective machining or develops flaws it may be discarded; in which case the manufacturer and purchaser, or his representative, shall agree upon the selection of another specimen in its stead.

IV. Workmanship and Finish

8. (*a*) The castings shall be free from blow holes, porosity, hard spots, shrinkage defects or cracks, or other injurious defects and shall be smooth and well cleaned,

(Concluded on Data Sheet No. 650)

TENTATIVE SPECIFICATIONS FOR ALUMINUM BRONZE CASTINGS

(Concluded from Data Sheet No. 649)

before inspection, by sandblasting, tumbling, chipping or other process approved by the inspector.

(*b*) The castings shall not be repaired, plugged, welded or *burned in* unless permission from the inspector previously has been secured. This permission will be given only when the defects are such that after the approved repair the usefulness and strength of the casting has not been impaired. Each such repair shall be encircled by a ring of white paint at the time of shipment.

(*c*) All castings shall be true to pattern, free from swells, etc. Wall thicknesses shall be uniform throughout the lot of castings and all cores shall be set accurately.

(*d*) Where thick and thin sections join, the manufacturer shall be permitted to add (where not previously provided) fillets of proper size to avoid cracking upon cooling subject to the approval of the inspector.

V. Marking

9. The castings shall be marked with pattern or mark number, and when practical with the melt or lot number, at a position on the castings where they will not be machined off in manufacture to finished dimensions.

VI. Inspection and Rejection

10. (*a*) Inspection may be made at the manufacturer's works, or at the point of delivery. Inspection shall be made at the option of the purchaser.

(*b*) If the purchaser elects to have the inspection made at the manufacturer's works, the inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

11. Castings which show injurious defects revealed by machining operations subsequent to acceptance may be rejected, and if rejected, shall be replaced by the manufacturer without charge to the purchaser. The full weight of the original material rejected shall be returned to the manufacturer.

THE FOUNDRY DATA SHEET, DEC. 15, 1926

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

Bill Says a Good Word For the Minority

By Pat Dwyer

ALTHOUGH I rarely read the sports page of the daily paper, still I entertain a certain kind of respect for the men who write the material for the self same page. I am not sufficiently familiar with the field of sport to judge the accuracy of the reports or whether the subject is covered in an adequate manner. The composition in many instances is slovenly and offends my sense of neatness and precision. To employ a foundry simile it resembles a mold with soft spots under the bars and with gagger marks all over the joint. The writers of these stories seem to be in the same class as the molders who leave loose sand in the bottom of a mold under the comforting reflection that the hungry iron will eat it up.

My feeling of respect for the writers is not for the quality of the material which rolls out under their nimble fingers, but for the quantity. How they do it day in and day out world without end, amen, is a never ending source of astonishment. To my limited intelligence one prize fight, one base ball game or one football affray is just like another and could be covered conveniently in a few paragraphs or at most in half a column. On innumerable occasions I have read statements by newspapers that the amount of available material is so far in excess of their capacity, they are forced to boil everything down to the bare essentials. Judging by the amount of space given over to some subjects, we poor readers are forced to one of two conclusions, either the pot is too small or the cook is nearsighted. A surprisingly large amount of material passes through the kitchen and is served up quite raw. Perhaps some day when Mr. Hoover's standardization committee has succeeded in cutting down shovels, shoes and hair cuts to three standard lengths, short, medium and long, this august body may turn its attention to the field of sport and develop a standard form for reporting athletic contests in a minimum number of words. The forms can be left standing with suitable gaps for the insertion of the names of the contestants. This suggestion is offered freely and without any hope or desire of pecuniary remuneration. It should meet with the whole hearted support of newspaper proprietors whose profits under present conditions are gobbled up by a horde of hungry space writers. Needless to say it would meet the approval of millions of readers who do not care who won or what it was all about.

For example consider the recent little difference of opinion between Mr. Dempsey and Mr. Tunney. Neither one of these gentlemen entertained a personal animus for the other. Each man felt he was a better man than the other. The word better in this instance does not refer to his morals. It simply means that he believed he could hit harder, quicker and more frequently than his opponent in a given period of time.

Millions of pairs of men have held similar views since the world began. Sometimes they put their views to a practical test and at other times they content themselves with nursing their views in private. In the first instance each man may or may not decide the point to his satisfaction. In the second instance he may enjoy the mental pleasure of reducing his adversary to a pulp without the risk of being converted into a hunk of dog meat himself. In either case I see no reason for the remainder of the population growing wildly excited over the affair.

If the two gladiators hereinbefore mentioned had retired to some quiet nook with a referee, or even without one, they easily could have settled the point at issue to their own satisfaction. That would have been the sensible course, since in the last analysis they were the only parties vitally interested. However, since they elected to make an exhibition of themselves I think newspapers could have conferred a favor on their vast army of peaceable readers by covering the subject in a few trenchant paragraphs. (1) Two naval heroes of the world war, Jack Dempsey who helped to build the ships and Gene Tunney who sailed in them today signed articles to decide once and for all time who won the war. Tex Rickard, who neither helped to build the ships or sail them has offered to defray expenses and stage the show for a nominal split of 50 per cent of the gate. It is claimed that Mr. Rickard does not expect to clean up

WHERE NOTHING IS SAVED BY A SHORT CUT

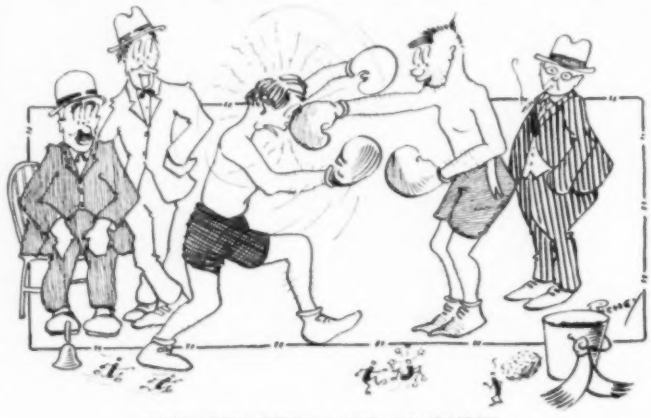
more than a beggarly pittance of $1,000,000. For many years this well known promoter has been notorious for his prospensity for taking long chances in the field of sport.

(2) Several months later. The fight for the heavy weight championship will be held appropriately in Philadelphia the city of brotherly love. The fact that a sesquicentennial celebration at present is running in the city may or may not have influenced the decision. In well informed circles it is claimed the decision was influenced solely by the motto of the promoters "The greatest good to the greatest number." Sport has languished sadly in the city since General Butler departed for the west coast. (3) Reports from the rival camps indicate that both men are training vigorously. According to exclusive information gained at first hand on the ground by our private correspondent (a) Dempsey is as fit as a fiddle. He will toy with Tunney for a few rounds. Then he will pound him into sausage meat and throw him into the garbage can. (b) Dempsey is all in. Nothing left but a shell. Tunney, the clean cut marine, is a living and combined personification of Hercules, Atlas and an Auroch bull. When Dempsey finally regains conciousness he will think he has been back in the shipyard with seven husky guys playing riveting guns all over his person.

(4) Youth will be served. This aphorism once more was exemplified last night at Philadelphia when Gene Tunney wrested the pugilistic crown from the head of the erstwhile wearer Jack Dempsey and incidentally bruised the physical crown of the party of the second part in the process. *Le roi est mort. Vive le roi!*

There is the whole story with a neat little tag line at the end to show, as Bill expresses it, that the newspaper man knows his onions. The ordinary citizen would say, "Well, the best man won," and let it go at that. If the newspaper man wrote "The king is dead. Long live the king" people would think he was silly and ask each other solemnly where the poor prune got that king stuff. By using the French phrase he puts an artistic finish to his paragraph and maintains himself on his pedestal. Instead of the foregoing pithy little story containing all the essential details served up one paragraph at a time several months apart we have been deluged for a year with—columns did you say?—Reggie, Reggie, be yourself—with pages and pages and more pages of absolute drivel about the two men.

One enterprising reporter had it on the best of authority from a man who knew a fellow who had seen a bird who had overheard a conversation in the subway between two lads who were arguing whether book learning was an asset or a liability to a prize fighter, that Tunney once had been seen reading a book. With characteristic enterprise this startling fact was broadcast to the world. Like a snowball the story gathered momentum and substance as it rolled along. By



THE SKIN THEY LOVE TO TOUCH

the close of the summer the single volume, probably a dog's eared copy of Nick Carter, had grown into a book lined library in seven languages and our hero was credited with spending his spare time in preparing a scholarly translation of some hitherto unknown philosophical treatises in the original Sanskrit.

Some day when I have succeeded in driving the wolf far enough away from the door to ensure a breathing spell, I intend to set about the formation of a national organization having for its object the elimination of all this ballyhooing in the newspaper section devoted to the review of sport, so called. As a preliminary I broached the subject to Bill last night. Somewhat to my astonishment he not only refused to become a charter member, but he actually intimated that I was hopelessly antiquated. I regret to say his exact words were,

"You poor nut, you don't know what you are talking about."

"Listen," I said, "while I quote you a few figures, conservative figures."

"Figures make me tired," Bill remarked, carelessly dismissing the argument with a wave of the hand. "They can be used to prove anything. However, if you are aching to get a few out of your system, don't let me stop you. The operation may ease your mind and since I have not the slightest intention of either believing or trying to remember them I kinda figure they won't do me any harm. Bring 'em along, singly or in platoons. I'm shock proof and figure proof."

"To borrow one of your own favorite banalities," I retorted, "I might say, 'So's your old man' but I scorn to adopt such a silly method of carrying on an argument. Listen. I'll try to make this thing so simple that even you can understand it."

"Thanks," said Bill. "Cut it short, short and snappy."

"Snappy is the word," I said. "I'll just snap the feet from under you. Approximately 150,000 people attended the prize fight in Philadelphia. Presumably if this crowd of enthusiasts was willing to pay a couple of million dollars to see the fight and a few million more in traveling expenses, it also was an ardent reader of all the stories covering the event. Assuming for the sake of argument that ten times that number were interested in the affair, but were deterred by financial reasons and otherwise from attending. That gives a total of 1,500,000 readers, a generous estimate, who appreciated the mess of drivel published in the papers.

"Continental United States is credited with a population of about 100,000,000. Eliminating the illiterate and children below reading age we have a potential reading public of at least 60 or 70 million.

"Now my lad, listen carefully. In this free and democratic country, the word democrat having no relation to politics, is it just, is it right that a pitiful minority of 1,500,000 should impose their wishes on a majority of 60 or 70 million? Our ancestors jeopardized their lives, their fortunes and their future in an effort to establish a free and constitutional government in which the wishes of the majority should rule. Should we, I ask you as free born descendants of these same ancestors, men who froze and starved at Valley Forge and dumped a cargo of tea in Boston harbor when tea was $2 a pound, should we, I repeat, the great majority of newspaper readers, submit to the clamorous desire of a small and pitiful sport loving minority?"

"Well," said Bill, "Since you ask me I'll tell you. Also I'll just use your own argument to turn you inside out. Originally the thirteen states were a minority, a decided minority

in the far flung British empire. Did this timid little minority creep into a hole and let the majority put it all over 'em?

"Minorities always are kickers. This would be a sad old world if it was not for their activities. The blessed spirit of revolt either in an individual or in an organized group against existing conditions, has been responsible for whatever measure of progress the human race has made since the first man fashioned a club and proclaimed himself ruler by the simple expedient of beating his followers into submission. The majority remained as followers, but the lively boys, the kicking minority fashioned better weapons, stone, bronze, iron and finally steel. They always were one step ahead. Although their motives primarily were selfish, their activities carried the race along with them. I won't go so far as to say that the sport page of a paper has elevated humanity to a more lofty plane. Its existence simply proves that when a vigorous minority wants something, it will get it. Where do you suppose the foundry business would be today if the minority was not continually breaking away from tradition and trying out new ideas? Some person once said it was a brave man who first ate an oyster. Maybe so. It depends on how hungry he was. I think the first man who poured metal in an iron mold was no coward. The man who invented the first jolt machine and claimed he could ram sand better and more quickly than it could be rammed by hand had to face a considerable amount of jeering before he succeeded.

"Men who are still far away from the sere and yellow leaf can remember the alibi put up by the sterling old cupola tender when the machine shop boss came storming into the foundry complaining bitterly about the hard spots in the castings that ruined his tools. No gaffer worthy of the name would accept any statement from the machine shop without a personal investigation. No machine shop boss that ever lived hesitated an instant in extending an invitation to come and see. Invariably on these occasions he marked a red cross on the calender.

"In the machine shop the machinist would point sneeringly to the casting. The foundryman would examine it carefully from every angle and pronounce it O. K. A little close in the grain, perhaps, but he had his orders to produce strong castings. If the machinist was not such a hog, trying to rip off a ½-inch cut with a blunt tool, incorrectly ground, he would find the iron all right.

"With honors even all around the foundryman would return to the shop and call the old cupola man down from his perch on a board resting on the upper ends of the two half doors. The old lad, plastered with mud to the eyes, would come spitting out like an angry tom cat and inquire profanely how he was going to get the furnace up for a heat if he had to drop his tools every five minutes.

"He would remove his old relic of a hat, slap it against the nearest post to remove some of the dust, gaze at it thoughtfully, replace it on his head, refresh himself with a chew from a mud covered plug, offer the gaffer a chew only to have it refused and then ask him what he had on his mind.

"After hearing the particulars he would ruminate for a few moments while his master mind rapidly analyzed the sequence of operation on the preceding day. Then unhesitatingly he would pin the blame on his helper. He had told the half wit a million times if he had told him once to remove all nails and spikes from the kindling wood. He didn't have 175 eyes and he couldn't be expected to be every place at one time. Without a doubt this bone headed assistant had thrown in some wood containing nails or spikes. This material had contaminated the metal and caused the hard spots in the castings.

"In our present day superiority we can laugh at the idea of any person taking such a statement seriously. Steel is added freely to the cupola charge in amounts varying from 10 to 50 per cent for practically all classes of gray iron castings. For special purposes and under exceptional conditions entire heats of steel scrap are melted in the cupola. Just the same, young feller me lad, the first man who deliberately added steel scrap to the cupola charge was of the stuff of which heroes are made. Medals have been struck for men who have rendered less useful service to the arts and sciences.

"Majority opinion is useful in many ways, but that is no reason for considering it infallible. Industry is so constituted that it cannot stand still. It must either go forward or go to the scrap pile. Minorities either individually or collectively are springing up all the time. Many of their ideas, in fact all their ideas are branded in the beginning as impossible, impracticable, red, radical and revolutionary by the staid, stick-in-the-mud, respectable and moss grown majority, but eventually they are adopted. For example consider bobbed hair and bobbed skirts—" "Good night," I said. "If you are going to discuss feminine fashions, you might just as well stop now. You don't know anything about them and neither do I and if you ask my private opinion I don't believe the wearers themselves know what they want. They will wear anything or nothing at all provided some person sets the fashion. They do not inquire if it is sensible, if it is right or wrong. They simply inquire if it is in style.

THE NEW MODEL PRESENTS SEVERAL INTERESTING FEATURES

Publish Bibliography

A bibliography on manganese steel by E. H. McClelland and Victor S. Polansky, with a preface by Sir Robert Hadfield has been published by the Carnegie Library of Pittsburgh. Previously, the bibliography has been published in the *Blast Furnace* and *Steel Plant* and partly in *Forging-Stamping and Heat Treating*.

Appointed Manager

W. M. Bastable, formerly general sales manager, Wilson Welder & Metals Co., has been appointed manager of the New York office of the Electric Welder Construction Co., Pittsburgh, with offices at 26 Cortland street.

Investigates Heat and Scale *Resisting Cast Irons-II*

Discusses Mechanism of the Breaking Down of Ordinary White Iron Under Heat Oxidizing Conditions—Gives Effect of Each Element

By Oliver Smalley

LACK of information on cast iron to withstand high temperature under oxidizing conditions, its uncertainty in service and the encroachment of costly heat resisting alloys into the cast iron field is the justification for reference to scale-resisting cast irons.

White irons made in the cupola, open hearth, or electric furnace are comparable, provided fundamental conditions of melting are observed and practiced. The cupola furnace which manufactures at the lowest cost is favored most widely. However, the abuse of this simple metallurgical unit, and the tendency to operate without adequate metallurgical control, are responsible for difficulties of control of composition, of temperature effects, of unsoundness and of such variation in the quality of the finished product, that the immediate monetary advantages of any reduced cost of the molten metal must be considered in relation to the ultimate life of the casting in service.

Mechanism of breakdown of ordinary white iron under heat oxidizing conditions proceeds as follows:

1. Dissociation of the carbides.
2. Loss of carbon at surface.
3. Oxide formation at surface.
4. Migration of carbon from center to surface.
5. Growth of the iron by repeated heating and cooling.
6. Loss of carbon from center.
7. Penetration of oxide between adjacent crystal grains.
8. Formation of oxide cavities and collapse.

Were it not that this breaking down process eliminated the natural brittleness and fragility, white iron would lose much of its serviceable value for high temperature work. Hence malleability, although indicative of the first stage of collapse of the iron under heat influences, is a necessary property gained only at the expense of an equally important one, viz.: Resistance to scaling. Therefore, any element in manufacture which adversely affects one or the other property is to be avoided, while any improvement or advance must necessarily improve the scale resisting powers without affecting robustness in service.

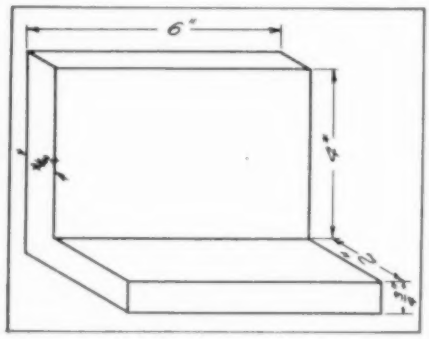


FIG. 7—SKETCH OF TEST SLAB USED IN HEAT TEST

Before white iron scales, the carbon first must burn away from the outer edges. Therefore it would seem that the higher the carbon content the longer the life of the iron. This would be true if all the carbon remained in the combined condition as carbide, but the higher the total carbon content, the sooner the deposition of free carbon (graphite) on annealing, everything else being equal. As this free carbon readily is combustible, and burns away, leaving in its stead enlarged cavities, and later oxide as shown by the photomicrograph of Fig. 6, a direct contradiction of the first premise is found. Therefore to consider the quantity of carbon without a knowledge of its stability as a carbide and constitution, may be more misleading than instructive. However, it may safely be stated that the higher the carbon, the longer the life, providing the graphitization period is not decreased. In other words, the advantage of an increased carbon content may be assured only by suitable adjustment of the other elements present.

Favoring the formation of graphite and readily oxidizing to silica, silicon is an undesirable element so far as longevity under the direct influence of temperature is concerned. Since silicon confers toughness, re-

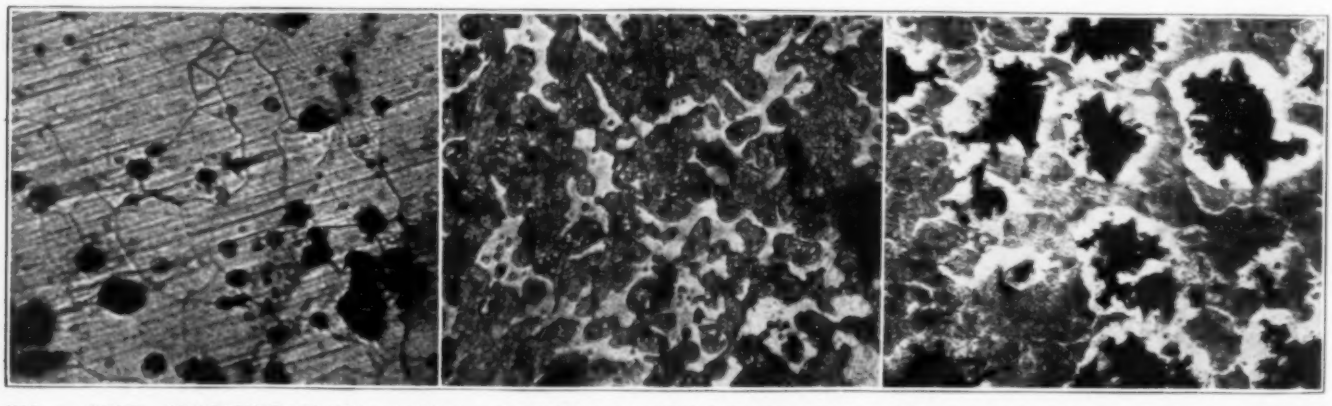


FIG. 6 (LEFT)—PHOTOMICROGRAPH SHOWING GRAPHITIC CARBON BURNED AWAY LEAVING LARGE CAVITIES. FIG. 8 (CENTER) IRON NO. 4 OF HEAT TEST SHOWING CONTROL ZONE OF SPECIMEN—X150. FIG. 9 (RIGHT)—IRON NO. 6 OF HEAT TEST SHOWING CONTROL ZONE OF SPECIMEN—X150

duces liquid shrinkage on solidification, and is the most economical natural deoxidant, only such quantities as enable solidity of casting and promote deposition of graphite at such a rate as will confer the desired toughness without accelerating oxidation, should be present.

Carpenter and Reegan in the *Journal Iron and Steel Institute*, 1911, show that with a constant carbon of 2.4 per cent and manganese ranging from 0.51 to 1.6 per cent, 151 heatings caused a volume increase of 7.49 per cent in the 0.51 per cent manganese bar. With 0.935 per cent manganese the same treatment produced an increase of 3.10 per cent and with 1.6 per cent manganese 151 heatings produced no change in volume.

A. Levi, discussing cast iron subjected to repeated heats and coolings at temperature not exceeding 900 degrees Cent. (1652 degrees Fahr.), states that "In the manufacture of heat resisting cast iron it is desirable in practice to obtain a high manganese or chromium content, these elements forming stable carbides which resist annealing. These carbides are the type $(FeMn)_3C$. Stability of these retards increase of volume subsequent to the first heat." Campion considers carbides of manganese more resistant to heat than the corresponding compounds of iron. Therefore, manganese plays an important part in preventing growth and loss of strength when the iron is subjected to high or fluctuating temperature conditions. The graphitizing influence of silicon is counteracted partially by manganese. Besides functioning to promote stability of the carbide, manganese is an efficient deoxidizer and cleanser, and neutralizes the influence of sulphur.

Sulphur exists in cast iron in three forms, as sulphide of manganese, sulphide of iron and organic sulphur.

The stability of the carbon as carbide, hence the resistance to scaling and growth, is a function of the quantity of sulphur that crystallizes with the carbide. Because of the powerful effect of sulphur in this direction and because of the preferential affinity of manganese for sulphur, forming an inert material, it would appear that high sulphur and low manganese would be more desirable in scale resisting castings than a low sulphur and high manganese. Its presence is undesirable, since it makes cast iron tender at a red heat, causes quicker solidification, and under certain conditions blowholes and dirty irons. It is considered that 0.01 per cent sulphur will neutralize 15 times as much silicon.

Phosphorus must be under rigid control since it renders iron more brittle under shock, reduces the strength hot, accentuates the deposition of graphite, and has a tendency to segregate. The fact that it makes metal more fluid and thin, reduces its melting point and decreases contraction, are features in its favor.

Table IV

Chemical Composition of Test Slabs

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Fracture
1	2.70	0.52	0.23	0.192	0.165	White
2	3.01	0.55	0.33	0.376	0.169	White
3	3.67	0.58	0.19	0.184	0.184	White

Table V

Loss by Scaling

No.	Total carbon per cent	Loss by scaling per cent	Fracture
1	2.70	30.2	Slightly mottled.
2	3.01	28.3	More Mottled than No. 1.
3	3.67	29.2	Mottled a little more than No. 2.

Table VI

Effect of Silicon on Test Slabs

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Fracture
4	3.01	0.55	0.33	0.376	0.167	White
5	3.174	0.66	0.34	0.380	0.165	White
6	3.270	0.79	0.32	0.364	0.210	White
7	3.261	0.98	0.35	0.400	0.198	White

Table VII

Per Cent Loss by Scaling

No.	Silicon per cent	Loss by scaling per cent	Fracture
4	0.55	28.3	Outer edge 1/8-inch crystalline, remainder just turning mottled.
5	0.66	28.1	Outer edge 3/32-inch crystalline, remainder distinctly mottled.
6	0.79	28.1	Outer edge 3/32-inch crystalline, remainder a little more mottled than No. 4.
7	0.98	29.0	Outer edge 1/8-inch crystalline, remainder fine gray.

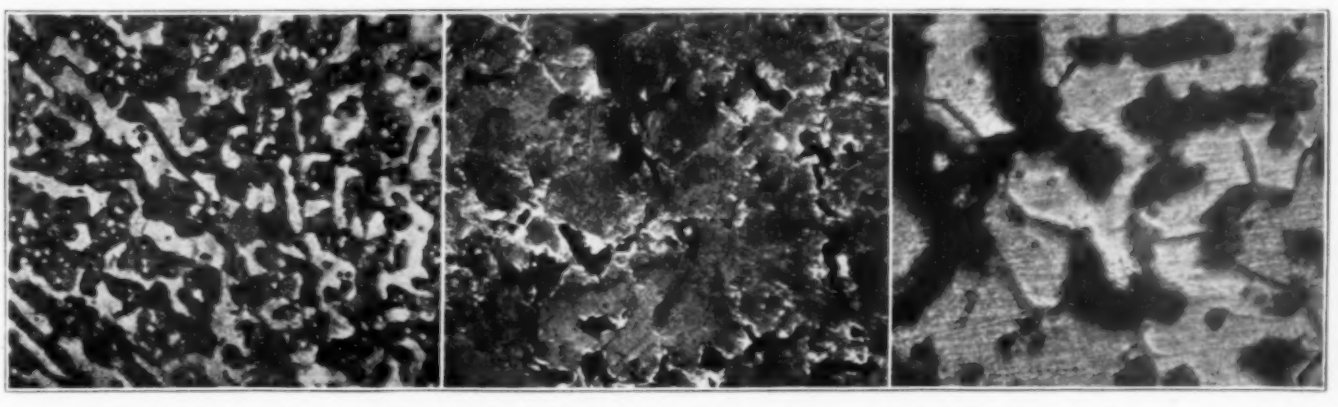


FIG. 10—MICROGRAPH OF CENTRAL ZONE OF SCALE TEST SLAB AFTER 14 DAYS CONTINUOUS HEATING—X150. FIG. 11—PHOTOMICROGRAPH OF CENTER ZONE OF OXIDIZED SLAB. FIG. 12—OXIDIZED IRON IN LAST STAGES OF COLLAPSE AFTER THE EXPERIMENTAL SCALING TESTS CARRIED OUT

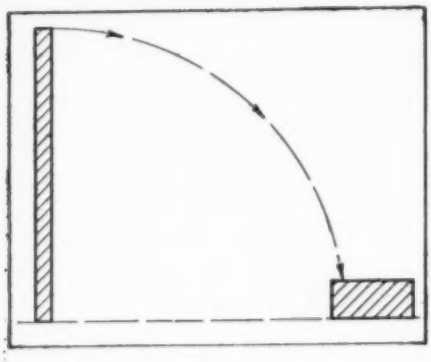


FIG. 13—METHOD OF TESTING BRITTLENESS

While exerting a profound influence, there is no reliable information on the quantity or the form gases take or of their ultimate effect on the physical properties and behavior of the iron in service. The work of Johnson, Oberhoffer, Piwowarsky, Jominy, Ekman and Jordan on this subject is well known. It is established that irons melted under oxidizing conditions have distinctive and different properties from those melted under reducing conditions, everything else being equal; but a method of estimating correctly the quantity and form of the various gases existing in cast iron still remains to be found. Although we have definite proof that iron melted with any excess of air takes a higher chill, possesses a finer grain, is more fragile and brittle hot, has greater strength and toughness at ordinary temperatures in the absence of any mechanical defects, no evidence exists that oxygen as such is the cause.

Make Heat Tests

To obtain more specific and comparative information on the relative effects of the various elements; the best combination of elements of white iron for high temperature work; and the effect of different melting conditions, a series of test slabs were cast from cupola melted iron in green sand to the form shown by Fig. 7.

Any adhering sand was removed and the iron slabs ground accurately. The slabs then were heated in an oil fired muffled furnace under oxidizing conditions to a temperature averaging 1600 to 1700 degrees Fahr. for 14 days continuously, arranging to cool each to a black heat in open air as quickly as possible every day and then to replace immediately, in the hot furnace.

The chemical composition of the irons and appearance of fractures are detailed in Table IV.

Under impact test slab No. 1 proved most brittle and No. 3 the best able to withstand shock. The per cent loss by scaling and appearance of fracture after tests are listed in Table V.

These show that the best results, as far as scaling was concerned, were obtained from the 3.01 per cent carbon iron, although No. 3 yielded the toughest iron.

Four castings of the composition given in Table VI were used to investigate silicon. Under impact test, the resistance to shock increased as the silicon content although none was exceptionally brittle.

In their relative capacity to resist oxidation on heating, the test bars did not display any real difference. The scale was very adherent to No. 3 but easily removed from No. 6.

The explanation of the apparent similarity to resist scaling is found from photomicrographs of Figs. 8 and 9 representing irons Nos. 4 and 6, respectively. These photographs were taken from the central zone of each specimen. Except for the presence of a few pit holes and a slight dissociation of the carbide, the structure of the 0.55 per cent silicon iron is unchanged. The carbon content of this zone is about 2.20 per cent. The photomicrograph of Fig. 9 shows that the effect of the increased silicon content has been to cause precipitation of patches of graphite (shown as black), which are surrounded by ferrite or pure iron. The matrix is carbide containing approximately 0.80 per cent carbon. The total carbon content of this zone may approximate 1.60 per cent.

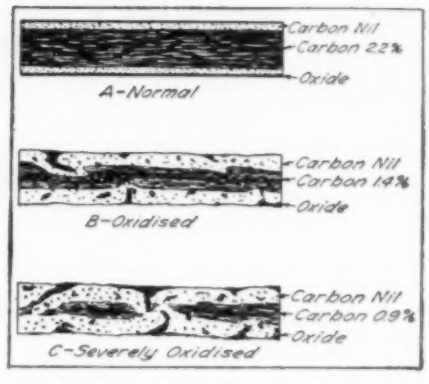


FIG. 14—SKETCHES OF CROSS SECTIONS OF SCALING TEST PIECES

The deposition of graphite in this specimen followed by subsequent oxidation has caused the iron to swell and for this reason the scaling test is somewhat misleading. However, it is obvious that in actual service this iron will have a shorter ultimate life than the lower silicon iron. It may be concluded that:

(1) 0.55 per cent silicon resists oxidation better than the higher silicon irons, presuming the castings are uniformly solid.

(2) Where toughness, because of the method of handling, is essential and where casting difficulties are encountered, the higher silicon series are preferred, but the silicon con-

Table VIII

Effect of Manganese on Test Irons

Chemical Analyses and Fracture

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Fracture
7	2.93	0.66	0.28	0.32	0.083	White
8	3.06	0.73	0.65	0.40	0.076	White
9	3.06	0.63	1.18	0.33	0.074	White
10	3.32	0.82	2.27	0.35	0.068	White
11	3.12	0.74	2.97	0.34	0.059	White

Resistance to Scaling and Appearance of Fracture After Test

No.	Manganese per cent	Loss by scaling per cent	Fracture
7	0.28	28.1	Outer edge ⅛-inch crystalline, center just turning mottled.
8	0.65	29.3	Outer edge ⅛-inch less crystalline than No. 7, center mottled.
9	1.18	30.2	Outer edge 7/64-inch less crystalline than No. 8, center mottled dark color.
10	2.27	30.5	Outer edge 3/32-inch very fine texture, center as No. 9, a little darker color.
11	2.97	30.2	Outer edge 3/32-inch fracture of hardened tool steel, center black color.

Table IX

Effect of Phosphorus on Test Irons

Chemical Analyses and Fracture of Test Iron

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Fracture
15	2.94	0.49	0.24	0.198	0.153	White
16	3.12	0.62	0.24	0.310	0.176	White
17	3.06	0.58	0.27	0.700	0.182	White
18	2.85	0.68	0.24	1.81	0.211	White
19	2.55	0.56	0.22	2.73	0.220	White Dull
20	2.20	0.55	0.21	3.41	0.238	White Dull

tent should not exceed 0.80 per cent.

(3) The silicon content should vary in inverse proportion to the section of the casting.

Thus far low manganese and high sulphur irons have been used for test purposes, and although each element is beneficial in increasing the stability of the carbide, yet they neutralize each other in this respect. It was decided therefore to employ low sulphur irons and thus eliminate the effect of the sulphur as far as possible.

Details of composition and appearance of the fracture of each iron are given in Table VIII.

A striking effect of the manganese was the refining influence on the outer zones of the metal in immediate contact with the scale. In the low manganese iron, the edges are coarse and crystalline, exhibiting bright facets. As the manganese content increases this band is reduced in dimension and the texture becomes finer until at 3.00 per cent it is almost silky. It was also observed that as the manganese content increased, the scale was less adherent.

The order of toughness after the scaling treatment was:

Iron No.	Manganese content Per cent
7	0.28
11	2.97
8	0.65
10	2.27
9	1.18

These results show that while manganese may be beneficial in reducing or preventing the growth of gray irons subjected to repeated heating and cooling and that while quantities of up to 1.50 per cent are considered advanageous in such castings as superheaters and fuel economizer headers, diesel engine parts, lead and antimony pots, special stoker and grate parts, etc., there is no advantage to be gained from the use of manganese in either low sulphur or high sulphur white irons.

It may be concluded from the above tests that manganese:

1. Reduces the resistance to scaling.
2. Increases graphitization.
3. Decreases strength, and that this element should not be allowed to exceed 0.30 per cent.

The compositions of irons made to investigate the effect of phosphorus are shown in Table IX. The fall in strength and increased brittleness accompanying a rising phosphorus content are indicated by the transverse test results listed in Table XI. Under impact tests, irons Nos. 18, 19 and 20 proved so brittle that in the presence of such quantity of phosphorus, white iron is unsuited for any purpose where strength and rigidity are required.

Table XII shows that the adherence of the scale diminished as the phosphorus content increased.

The toughness after the scaling treatment was similar in irons Nos. 15 and 16. Iron No. 17, while more brittle than irons Nos. 15 and 16, was sufficiently tough for ordinary service conditions. Nos. 18, 19 and 20 were brittle.

Phosphorus Exerts Influence

These tests show that phosphorus in normal quantities common to ordinary scrap iron is not detrimental. When present in excessive quantities it exerts a marked influence. The exact nature of this influence is not shown clearly by the scaling tests, for the failure of irons Nos. 19 and 20 is not due to rapid oxidation alone but to the adverse effect of phosphorus on the strength of the iron hot. It is for this reason rather than because of excessive scaling that phosphorus must be avoided. Where the service temperature reaches 1600 degrees Fahr. 0.50 per cent is the maximum quantity permissible for ordinary purposes; where 1650 degrees Fahr. is reached 0.35 per cent is a safe maximum; and where a temperature of 1700 degrees Fahr. is encountered 0.20 per cent should not be exceeded.

Three casts were made with sulphur; 0.083 per cent, 0.167 per cent and 0.326 per cent. Details of chemical composition and appearance of fracture as cast are given in Table X. When correctly melted and poured suitably hot, the liquid shrinkage and general soundness of each iron were satisfactory. If oxidized or poured cold, high sulphur caused unsoundness and excessive drawing on solidification. Under impact test alloy 14 proved most brittle.

The microstructure at the central zone of the scale test slab after 14 days' continuous heating is shown in Fig. 10. This is similar to what it was before heating. The carbon content was about 2.6 per cent.

In that high sulphur has reduced scaling some 3 per cent, it is beneficial; in that it embrittles and that this excessive brittleness is not removed after long annealing, it is detrimental. For this reason excessively high sulphur should be guarded against, although where heavy sections and severe oxidizing conditions are encountered, it has exceptional value. For general purposes a sulphur content of 0.20 per cent is recommended.

Oxidized Iron Disadvantageous

Drops of iron in their descent over the incandescent coke of the tuyeres region of the cupola may be oxidized to a greater or lesser degree, determined by the nature of the irons melted, the coke to iron ratio, the blast pressure and the speed of melting.

Increasing the stability of the carbides under heat influences and enabling a deeper chill, are advantages of white irons made under strongly oxidizing conditions. The disadvantages are: Rendering control of chemical composition uncertain; inducing a weak crystal structure and high liquid shrinkage which causes excessive cracking in manufacture; increasing the susceptibility of the iron to fracture on sudden heating and cooling; and being responsible for both surface and internal mechanical defects. The

Table XI

Effect of Phosphorus

No.	Phosphorus per cent	Transverse strength pounds	Deflection in inches
15	0.198	4,410	0.11
16	0.310	3,670	0.10
17	0.700	3,390	0.10
18	1.810	3,320	0.09
19	2.730	3,020	0.08
20	3.41	2,320	0.04

Table XII

Loss by Scaling

No.	Phosphorus per cent	Loss by scaling per cent
15	0.198	28.2
17	0.700	26.3
18	1.810	27.0
19	2.73	38.0
20	3.41	63.0

Table XIII

Effect of Sulphur

No.	Sulphur per cent	Loss by scaling per cent	Fracture
12	0.083	28.1	Mottled
13	0.167	28.0	Slightly mottled
14	0.326	25.3	White

Table X

Effect of Sulphur on Test Irons

No.	Total carbon per cent	Silicon per cent	Manganese per cent	Phosphorus per cent	Sulphur per cent	Fracture
12	2.93	0.66	0.28	0.32	0.083	White
13	3.00	0.55	0.33	0.376	0.167	White
14	3.02	0.51	0.26	0.37	0.326	White

advantages are more than offset by the disadvantages.

As modern tendency is directed toward cheapening the cost of castings rather than establishing and selling to a predetermined service guarantee, average cupola practice inclines toward oxidizing conditions. It is not uncommon to hear claims of successful melting using a 1 to 10, 1 to 12, or 1 to 14 coke to iron ratio, but investigation invariably reveals that the saving in coke is more than absorbed by the increased expenditure of irons. Foundries, using all scrap mixtures, have been known to offer bonuses to their superintendents on coke saving, a pernicious practice that often succeeds in increasing the number of bad castings, waste metal and ladle repairs.

The most baneful effects of oxidized conditions of melting manifest themselves in both chilling and white irons. To demonstrate practically the effect of an oxidizing condition on the heat resisting properties of white iron, a series of test slabs were made, varying the degree of oxygenation by increasing the blast pressure, using light scrap and reducing the quantity of coke. The extent of oxygenation was measured by the color of the fumes from the cupola stack which varied from a light gray to a deep red.

Under correct melting conditions, the liquid shrinkage of this iron on solidification approximates 1.3 per cent. When deep brown fumes are pouring from the cupola stack, it is 6.3 per cent. These specimens represent iron melted under satisfactory conditions when the fumes of the stack were free from red color and the other when reddish brown fumes were omitted. The brinell test failed to reveal any difference between the hardness of correctly melted and oxidized irons.

Brittleness increased in direct relation to oxidation, casting temperature and rate of cooling. This was measured by allowing a plate 1-inch thick and 24 inches long to fall from the vertical through an angle of 90 degrees on to the edge of a cast iron block as represented in Fig. 13.

Under similar conditions of casting temperature and rate of cooling, metal correctly melted could not be broken by the dropping test, whereas oxidized metal broke readily, sometimes on the first fall. Casting strains from uneven cooling, weak crystal structure from casting too hot, and too rapid cooling, exert an equally embrittling influence on both the correctly and incorrectly melted metal.

Sections through the test slabs on scaling show that because of the general unsoundness of those cast from oxidized metal, and because of the presence of mechanically contaminated oxide, any comparison of the relative loss of scaling is unfair, for in some places the severely oxidized slabs were almost eaten through, and wherever an oxide inclusion existed on the outer surface of the casting, this was sufficient to start a local attack which rapidly penetrated the mass. The general appearance of the normal, medium, and strongly oxidized metal after scaling tests are shown by the cross-section etchings *A*, *B* and *C* of Fig. 14. Where the sections of the test slabs made from oxidized metal were not pitted or otherwise unsound, the loss from scaling was 3 to 4 per cent greater than that of the ordinary melted metal. The more rapid loss of carbon from the oxidized metal is apparent from the increased thickness of the carbon free zones in immediate contact with the scale shown by etchings *B* and *C* of Fig. 14, while the photomicrograph of Fig. 11 shows the center zone of the oxidized slab to contain less than 0.90 per cent carbon. The black patches in this photograph surrounded by a white border is contaminated oxide. The photomicrograph of Fig. 12 shows an oxidized iron in the last stages of collapse after the scaling test.

It may be concluded that any practice conducive to oxidation, unless corrected by subsequent treatment either in the ladle or by duplexing, creates a condition which not only impairs the general physical properties of the iron, but materially shortens its service life under heat oxidizing conditions.

Daubing For the Cupola

Question: After each heat in our 24-inch cupola we daub the interior from the bottom door to a point about 30 inches above the tuyeres with a ½-inch coating of a mixture made up of sand 3 parts and clay 1 part. Is this necessary?

Answer: Daubing to renew the lining only is required on that part of the lining which is burned away at each heat. This area is known as the melting zone, or the zone of greatest temperature. It begins at a point a few inches above the tuyeres and extends upward several inches. In extreme instances or in long heats quite a hollow is gouged in the brickwork in this area and it may be necessary to use small brick bats or splits to bring the lining back to size, but usually a heavy coat of daubing from ½ to 1 inch is sufficient. No daubing is required below the tuyeres or above the melting zone.

Foundrymen See Tests of Molding Sand

A practical demonstration of modern methods for testing molding sand followed a dinner at the Hotel Cleveland, Cleveland, Nov. 29, which was attended by 62 foundrymen comprising representatives in the Cleveland district of the Ohio State Foundrymen's association. The tests were made by H. B. Hanley, Whitehead Bros. Co. laboratory, Rochester, N. Y. on apparatus which has been recommended and in some cases developed by the joint committee on molding sand research of the American Foundrymen's association.

Considerable interest in the subject of molding sand and methods of testing was aroused at a meeting of the group on Nov. 1, when Mr. Hanley gave an illustrated talk on the mining and preparation of molding sand. At that time he was invited to bring the testing apparatus used in his laboratory to Cleveland to demonstrate sand testing. The equipment used consisted of the permeability apparatus, the shear or fracture machine, the balance and the rammer and moisture determining device.

Mr. Hanley first made a test of a molding sand used in malleable work, showing the permeability and bond strength of this sand when properly tempered. He then made several tests to show how the addition of core sand or sea coal in excess will affect the permeability and bond strength. The detrimental effect of excessive moisture in heap sand also was demonstrated. Twenty-seven samples of sand from the floors of gray iron, malleable, steel and nonferrous shops in the district were tested by Mr. Hanley.

As an additional feature to the meeting, L. A. Hartley, director of education, National Founders association, Chicago, spoke on the relation of the human factor in industry. Through the aid of charts and pictures, he drew a parallel between the human body and the individual workman.

O. J. Blank, Peck, Stowe & Wilcox Co., Cleveland, presided. The next meeting of the group will be held shortly after the first of the year and the subject of sand reclamation will feature the meeting and follow up the preceding talks on sand.

Brass and bronze goods exported to foreign countries in 1925 show an increase of $6,173,000 or 49.8 per cent in value, according to the foreign commerce department of the United States chamber of commerce.

How and Why in Brass Founding

By Charles Vickers

Iron Spoils Castings

We are sending for inspection a piece of bushing which illustrates the difficulty we encounter which as you will note is a bad state of porosity. We melt in a gas-fired furnace and our mixture consists of copper 77 per cent; tin 8 per cent; lead 15 per cent. We add from 10 to 15 per cent return gates to the heat.

The cause of this peculiar porosity problem is undoubtedly iron in an oxidized state. The hard spots, the gas holes and the dark colored inclusions, all have their origin in this element. Where it is derived from we cannot tell from the meager data given. While the alloy formula is given, it has not been divulged whether the metals used are virgin or scrap, and while a gas-fired furnace is used for melting, it is possible that no crucibles are being used. Wherever the iron comes from, there is no doubt of its presence in quantity as this has been determined by analysis. It is well known also to metallurgists familiar with the many peculiar reactions due to the presence of iron, carbon and oxygen in copper alloys, that this element will produce the difficulty illustrated by this sample.

We suggest that an investigation be made to determine where the iron comes from so that its presence may be eliminated, and the difficulty removed.

Makes Oilless Bearing

We have an inquiry from buyers of bronze castings for a bronze and graphited bearing, or a bronze mixture containing lubricating graphite, so in the result they will have an oilless bearing. Can you tell us anything about such a material?

It is doubtful, even supposing that graphite could be so mixed with bronze that the mixture could be cast like ordinary bronze giving a metal with graphite perfectly mixed throughout, whether such a material could be used for bearing purposes without at the same time using some lubricating substance, such as oil or grease, due to the fact that while graphite is hard and will score metals, in the case of lubricating bodies containing graphite, the latter has to be divided so finely as to be in a colloidal state, otherwise it would not be held in suspension in the oil, and would cut the metals with which it came into contact.

Graphitic bearing materials now are being manufactured by a process of reduction of mixed metal oxides with graphite, but such metal cannot be cast into molds. It is also possible to treat phosphor bronze so that it becomes plastic like tinner's wiping solders, in which condition it may be impregnated with graphite by simply stirring it into bronze, but such material has to be extruded. Just as quickly as the temperature is increased to liquefaction, the graphite is released and floats to the surface of the liquid. In other words such material cannot be cast because it is an admixture of a nonsoluble, nonmetallic substance with a metal and it is not possible to shape it into forms by molding and casting processes. Oilless bushings are also made by spirally grooving the bearing surfaces and filling the grooves with a compound consisting of graphite and grease with a suitable binder.

Make Dies from Alloy

Can you suggest an alloy from which we can make dies for a dental laboratory. It should be medium hard, not brittle, melt at a low temperature and give a smooth casting when cast in plaster molds.

Richardson's alloy consisting of zinc 80 per cent, tin 20 per cent is used for dies for swaging plates; the contraction on cooling is practically nil. A softer alloy used for the same purpose is Fletcher's alloy consisting of zinc 66.5 per cent; tin 33.5 per cent.

A valuable alloy for dental work is Claudet's metal consisting of tin 91 per cent; antimony 9 per cent, and is the alloy that will be most suitable for the service mentioned. If too soft for some work it can be hardened by increasing the antimony; thus a typical alloy is tin 80 per cent; antimony 20 per cent. Between the range of 9 per cent antimony and 20 per cent antimony as given above a selection may be made of an alloy that will exactly meet the requirements given in the specifications.

Metal Is Poured Too Hot

We send you a section of an aluminum alloy casting which must be highly polished. You will note that it is full of small black specks. We are using scrap aluminum and are melting in a crucible using a proprietary flux. There are times when we are not bothered with the black specks, and desire to learn if we can overcome this difficulty and still use the scrap material?

Black specks are gas holes filled with polishing compound. Some investigators believe the gas exists normally in the aluminum alloy; that under certain conditions it is held in solution, and therefore does not show as holes, or porosity, and under other conditions, that the gas is thrown out of solution. The conditions alluded to are, rapid chilling of the alloy, as when it is cast in metal molds, and slow chilling or cooling which permits the gas to escape. Others believe the gas is diffused hydrogen obtained by decomposition of the moisture contained in the sand of the mold, and which is responsible for the condition of porosity.

Whichever of these two theories is correct, the remedy is the same. Namely, to pour the metal into the molds at as low a temperature as it is possible to run good castings. The casting in question being massive can be poured with metal of a silvery color, and not red, as that would be too hot. The chances are that sometimes the molds have been poured cool and sometimes quite hot. In pouring a long row of molds it is necessary to make a start with hot metal. The remedy is to pour fewer molds at a time, and pour at a lower temperature. Use a small amount of chloride of zinc and get the additions red hot as the pot is filled.

Gives Analysis of Bronze

Could you please give us the analysis of the alloy known as Parson's manganese bronze?

Parson's manganese bronze has about the following formula: copper 56.48 per cent, zinc 40.84 per cent, tin 1.15 per cent, iron 1.20 per cent, manganese 0.11 per cent and aluminum 0.20 per cent.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor
CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Let Them Have 'Em

DRAWING on now toward the close of the year, the period when annual statements in all their naked simplicity condemn or confirm the business policy of the preceding 12 months, the foundryman is inclined to one of two courses. Either he will retire into his shell and view conditions through a jaundiced eye or he will pat himself comfortably on the back, depending on whether the figures in the statement are written in red or in black ink. Whether he has gained or lost money during the year, the closing days are apt to find him in a reflective mood. How should he improve conditions if the year has been unsatisfactory. How can he maintain existing conditions in event the flowing tide now setting free and full toward the port of his desire should swing into a cross current, or, turning on the ebb, threaten to carry him into dangerous waters.

SOMETHING over a year ago a great commotion was raised by one political party in England because a certain ship contract went to Germany. The claim was made that with the facilities, position, financial standing and prestige of the greatest shipbuilding nation in Europe, and therefore in the world, on hand, it was a positive disgrace to let the vessels go elsewhere. "Cut the profits" cried the disgruntled politicians and the disgruntled politician's press. "Cut the profits on this one job. You have made enough on other contracts. Take the thing at cost for the honor of the empire and the relief of thousands of patriotic, but at present idle and hungry British artisans." With characteristic British dignity the owners of the big yards issued a brief and dignified statement to the effect that they had taken all these factors into consideration and then had submitted figures which included no profit. The public of course placed no confidence in this statement, particularly when they learned that the German yard had taken the contract for approximately 30 per cent less than the lowest figure submitted by any of its British competitors.

Recently the German shipbuilding company blew up with a loud financial bang, another sacrifice on the altar of ignorance and good intentions. The first law of economics is that to realize a profit, the income must exceed the outlay. The second law is, or should be, when a competitor offers to take a job below cost, let him have it.

¶ They Must Be Shown

PHYSICAL properties of molding sand now may be determined in less than ten minutes with little effort on the part of the tester. The years of work of the joint committee on molding sand research in conducting tests to determine standards for permeability, bond strength, moisture content and other essential properties have unearthed information of great value to every foundryman. When testing of molding sand first was started, hours and sometimes days were required to complete the tests. Now machines, developed by members of the committee and foundrymen who have given much of their time to the subject of sand testing, have reduced the time of testing to a few minutes.

WHILE the committee has gone far in the research, its work has only started. One task that stands out prominently is the selling of the idea of scientific sand control to every foundryman. What is the best method of accomplishing this result? Will the reports of the committee and the discussion at the annual convention be sufficient to put across the big idea? Probably not, for perhaps less than 300 foundries in the country are testing their sand scientifically. A more spectacular method must be used to sell the multitude.

PERHAPS a lesson along this line may be learned from the meeting of foundrymen held recently at Cleveland. Approximately seventy men sat from six to eleven-thirty to see a practical demonstration of the recommended testing machines by a man who has spent years in studying foundry sand. Here is the part that held the interest. The tests were made on approximately 30 samples of sand from gray iron, malleable, steel and nonferrous shops in the district. Such a demonstration helps wonderfully to clinch the idea of scientific control.

Trade Trends in Tabloid

PRE-INVENTORY cessation of buying is the announced reason for a slackening in castings buying in the larger manufacturing centers. The year just drawing to a close has been a record breaker in many lines of production. Foundry business has been good, but has not been accompanied, in many instances, by an adequate return on the castings sold. Competition has been keen, notably in general jobbing lines. Cast-iron pipe foundries are working full time at the close of three highly satisfactory years of production. Automotive shops expect an early pickup after the quiet which has characterized November and early December bookings. The outlook for the implement business is characterized as favorable. Railway orders still are scarce, although freight car loadings have stood at the peak for many months. Production of pig iron in November, totaled 3,236,940 tons, according to *Iron Trade Review*. This gives an increase of 343 tons per day over the preceding month. Merchant iron totaled 723,528 tons in November and 713,352 tons in October. Average prices for nonferrous metals for November, according to New York quotations in the *Daily Metal Trade* follow: Casting copper, 13.488c; electrolytic copper, 13.802c; Straits tin, 70.703c; lead, 8.04c; aluminum, 27.00c. Zinc averaged 7.216c, E. St. Louis, Ill. Brass foundry operations continue at a fairly high level for the month.

RAW MATERIAL PRICES

Iron

Dec. 7, 1926

No. 2 foundry, Valley	$19.00 to 20.00
No. 2 southern Birmingham	20.00
No. 2 foundry, Chicago	21.00
No. 2 foundry, Philadelphia	23.76 to 24.13
No. 2 foundry, Buffalo	20.00
Basic, Valley	19.00
Basic, Buffalo	19.00
Malleable, Chicago	21.00
Malleable, Buffalo	19.00 to 20.00

Coke

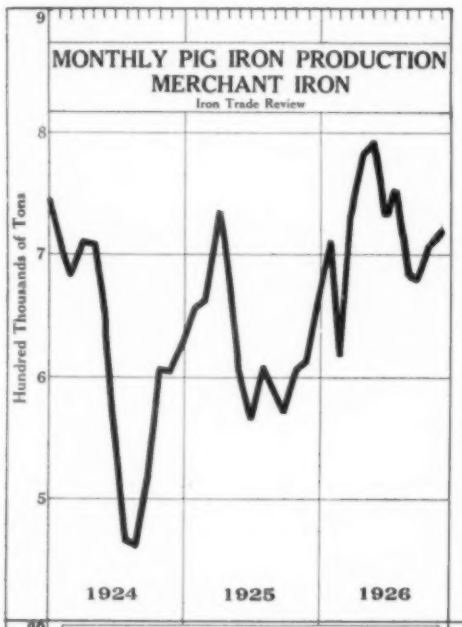
Connellsville foundry coke	$5.00 to 5.50
Wise county foundry coke	6.00 to 7.00

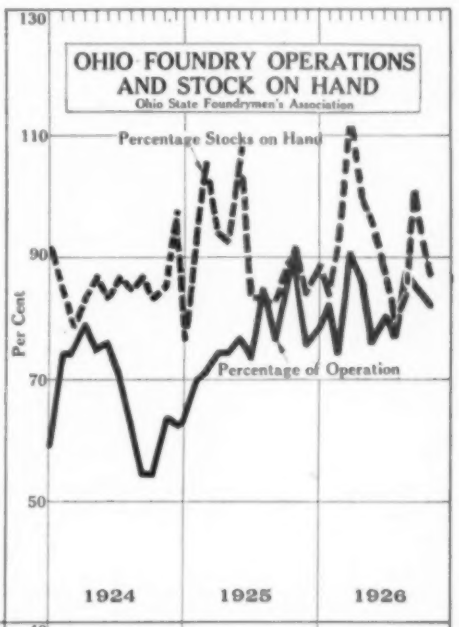
Scrap

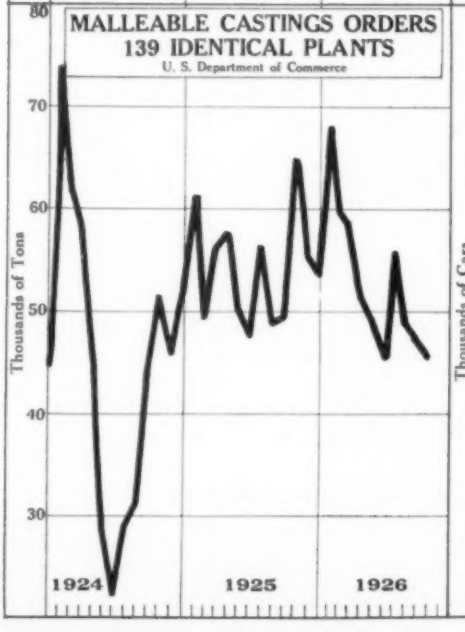
Heavy melting steel, Valley	$16.00
Heavy melting steel, Pitts.	17.00 to 17.50
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	14.00 to 14.50
No. 1 cast, New York	14.50 to 15.00
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.00 to 17.50
No. 1 cast, Pittsburgh	16.00 to 16.50
No. 1 cast, Birmingham	16.00 to 16.50
No. 1 cast, Buffalo	15.25 to 15.75
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.75 to 15.25
Railroad malleable, Chicago	16.00 to 16.50
Agricultural, mall., Chicago	15.25 to 15.75
Malleable, Buffalo	17.50 to 18.00
Railroad malleable, Pitts.	17.00 to 17.50

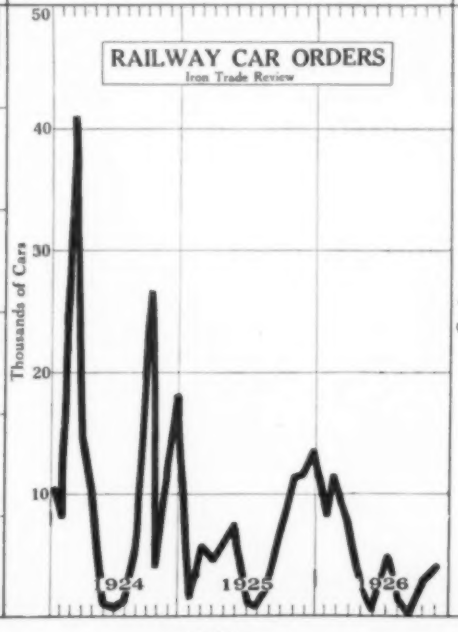
Nonferrous Metals

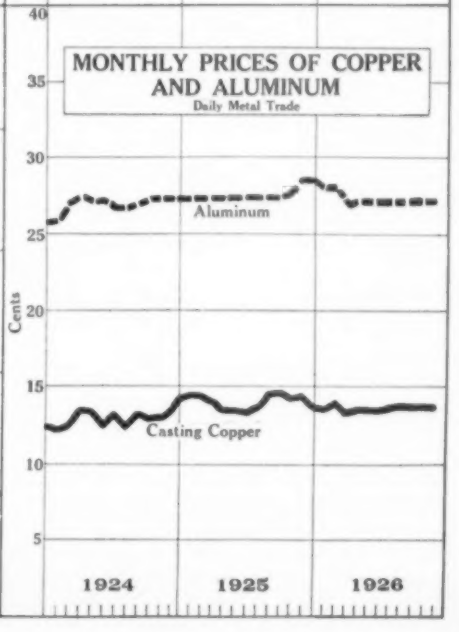
	Cents per pound
Casting copper, refinery	13.20
Electro copper, producers	13.50
Straits tin	70.50
Lead, New York	7.95 to 8.00
Antimony, New York	13.62½ to 13.87½
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	25.50
Aluminum, No. 12 remelt	21.50 to 22.00
Zinc, E. St. Louis, Ill.	7.00 to 7.05











Personal

T. A. Clark, general manager in sales and production, and also secretary and treasurer, Standard Engineering Co., Ellwood City, Pa., has resigned.

George M. Dyke, assistant secretary, Chain Belt Co., Milwaukee, has resigned to become a director and treasurer of the Stearns Conveyor Co., recently acquired by the Chain Belt Co.

G. W. Gilderman, foundry superintendent, Dodge Mfg. Co., Mishawaka, Ind., addressed the members of the Fort Wayne branch of the American Steel Treaters society at Fort Wayne, Ind., on Nov. 23. His subject was "Hidden Elements."

E. Bollinger, formerly assistant superintendent of foundries, Escher Wyss & Co., Zurich, Switzerland, now is foundry superintendent of F. E. M. U., Palma, Spain. He served four years apprenticeship and then studied mechanical engineering. After graduation Mr. Bollinger worked in the laboratories of the Escher Wyss company and in 1920 left this firm to study working methods in other countries. He worked in foundries in Spain, United States, Scotland and England. Since 1923 he has been assistant at Escher Wyss Co.

I. Edmund Waechter, formerly metallurgical engineer, General Chemical Co., New York, now is engaged in consulting metallurgical and chemical engineering practice at Tampa, Fla. He was graduated from Harvard university and received the degree of metallurgical engineer from the Massachusetts Institute of Technology in 1917. Mr. Waechter was metallurgical engineer for the Standard Tool Co., Cleveland; electric furnace melter for the Crucible Steel Casting Co., Cleveland, and metallurgical engineer with the Cleveland Hardware Co., Cleveland. He also was works manager and secretary-treasurer of the Baker-Waechter Co., Cleveland, and metallurgical engineer for the Brown & Sharpe Mfg. Co., Providence, R. I.

Establishes New Division

The Box Crane & Hoist Co., Philadelphia, has established an electric hoist division with R. H. McGredy as sales manager. Mr. McGredy formerly was sales manager of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. The Box company also has established a Chicago office in charge of R. G. Wadd. G. A. Mitchell continues as secretary and director of sales.

Changes Connection

O. M. Olsen, formerly field engineer for the United States Silica Co., Chicago, on Jan. 1, will become associated with the American Foundry Equipment Co., Mishawaka, Ind., as consulting field engineer and representative of the president of the firm.

O. M. OLSEN

He has done much investigation on sandblast practice to determine the practical considerations involved. At various times Mr. Olsen was connected with the Chicago Daily News, Chicago Tribune, Shuman Advertising Co., and with the United States Silica Co.

Has Charge of Sales

Frank D. Manning has been given charge of sales in the New York territory for the Osgood Mfg. Co., Marion, O., manufacturer of steam shovels, cranes, and other equipment. H. S. Beals and J. J. Kennedy, formerly with the Harnischfeger Corp., Milwaukee, now are associated with the Osgood company.

Acquires Plant in Ohio

The plant of the John F. Byers Machine Co., Ravenna, O., has been sold to Glenn P. Cowan, Detroit. The plant consists of gray iron, brass and aluminum foundries, and pattern and machine shops. It is said that $1,400,000 was paid for the property.

Obituary

Thomas H. Mirkil Jr., Philadelphia district sales manager for the Treadwell Engineering Co., Easton, Pa., died Nov. 12.

Alfred James, pioneer foundryman of La Crosse, Wis., died unexpectedly following an operation on Nov. 25, at the age of 70 years. He was born in Shrewsbury, England, in 1856, and with five brothers emigrated to America. Alfred and John James settled at La Crosse in 1873 and established a foundry.

Allan J. Goodhue who retired as western sales manager, United States Cast Iron Pipe & Foundry Co., Burlington, N. J., after many years' service, died at his home in Hinsdale, Chicago, Nov. 16, at the age of 82 years. He was born in Akron, O., and was a Civil War veteran. Mr. Goodhue retired from active business in 1919.

Becomes Sales Engineer

G. M. Eaton, formerly chief mechanical engineer, Westinghouse Electric & Mfg. Co., now is associated with the Molybdenum Corp. of America in a sales engineering capacity. Mr. Eaton who has been associated with the Westinghouse company for 20 years is a native of Worcester, Mass., and was graduated from the Polytechnic institute of that city. He became connected with the Westinghouse company in 1906 after serving some years with the Newport News Shipbuilding & Drydock Co., and the Union Iron Works, San Francisco. In 1910 he was appointed division engineer of the railway department and chief mechanical engineer in 1919. In addition to his new work, Mr. Eaton will serve as consultant on mechanical engineering for the Westinghouse company.

Experimented with Iron Forty Years Ago

By Robert E. Masters

In my early experience Scotch pig iron was regarded as a standard by which all other irons were measured. Any foundryman who did not carry at least a little of the genuine Scotch pig iron in stock for certain classes of castings was regarded with suspicion. The demand for this iron was so steady and insistent that some blast furnace interests, anticipating present day conditions in other lines, bootlegged their product as American Scotch

pig iron. They claimed the iron was made according to the Scotch process and contained exactly the same elements in the same proportions. Certainly their iron was no better or worse than it was before, but they sold a considerable quantity on the strength of their claims to gullible customers. Charcoal pig iron seems to be disappearing from the market. In former days it was used freely and was considered an absolute necessity in castings where strength was the principal feature. Cast iron car wheels were made exclusively from charcoal iron. The cupola charges were made up from varying proportions of scrap car wheels and charcoal pig iron. The proportions varied from 50-50 to 65 scrap and 35 pig iron. The scrap car wheels of course were assumed to contain nothing but charcoal iron in their composition.

As far back as 1884 I experimented with the addition of coke iron to the wheel iron mixture. About 20 per cent of good coke iron in a molten condition was taken from the jobbing foundry and poured into one of the wheel ladles. The ladle then was filled with regular wheel iron metal which was poured into the wheel mold.

After subjecting a number of wheels made in this manner to all the regular wheel tests, I laid the proposition before General Joseph R. Anderson, founder and president of the Tredegar Co., Richmond, Va. Despite the proposed saving in manufacturing cost, he would not consent to the addition of coke iron. He claimed the venture was too hazardous and if anything happened to one of the wheels, the fact that it was not made wholly from charcoal iron would reflect unfavorably on the high reputation enjoyed by the Tredegar Co. His decision stopped further experimenting along that line. A few years later at another plant where steel axle turnings always were available we placed a mass of these shavings in the bottom of a wheel ladle, filled it about 25 per cent full with coke iron and then filled the remainder with the hottest kind of wheel iron and let it stand for a short time to absorb the steel. Wheels poured from this mixture showed a good, even chill and withstood all the tests used at that time better than wheels made from a regular charcoal iron mixture. However, they never were placed in service, because they did not comply in every respect with the specifications of of the Master Car Builders association. Conditions have changed to a considerable extent in the lapse of 40 years.

Faked Foundry Facts

A Riddle

Shanafelt Mfg. Co., Canton, O., has appointed the Squire-Cogswell Co., Chicago, and S. R. Vanderbeck, Philadelphia, as district representatives.

Northern Blower Co., Cleveland, has appointed Herbert Roush-Kolb as its sales representative at Detroit with offices at 2640 W. Philadelphia avenue.

Foundry Association Directory

American Foundrymen's Association

President, S. W. Utley, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. Hoyt, 140 South Dearborn street, Chicago; technical secretary, R. E. Kennedy, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Insitute of Technology, 3200 Federal street Chicago; secretary, ROGERS A. FISKE, 10 S. LaSalle street, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Brondway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, J. W. Paxson Co., Luzerne and D streets, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co., N. E. Pittsburgh; secretary-treasurer, WM. J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

Select Chicago for 1927

Board of Directors of A. F. A. Decide 1927 Convention Will Be Held June 6-10—Executive Committee Named

CHICAGO was selected as the location of the 1927 convention of the American Foundrymen's association at a meeting of the board of directors of that organization held at the Edgewater Beach hotel, Chicago, Dec. 7. The annual meeting next year will be held June 6-10. As was announced during the Detroit convention, the 1927 convention will be held without the exhibition of equipment, the next exhibition of foundry equipment being scheduled for the 1928 convention to be held in the spring of that year. The selection of a location for the 1928 convention and exhibition was deferred.

The meeting Dec. 7 was held in accordance with the by-laws of the association which specifies that a meeting of the board of directors be held within 90 days after the close of the annual convention. At that meeting, S. Wells Utley, Detroit Steel Casting Co., Detroit, president elect, and S. T. Johnston, S. Obermayer Co., Chicago, vice president elect, took office. C. E. Hoyt was re-elected executitve secretary of the association and manager of exhibits and Robert E. Kennedy was re-elected secretary.

The executive committee of the board of directors for 1927, which was elected at the Chicago meeting, is as follows: S. Wells Utley, president; S. T. Johnston, vice president; C. E. Hoyt, executive secretary; L. W. Wilson, Federal Malleable Co., Milwaukee; Wm. J. Nugent, Nugent Steel Castings Co., Chicago; A. B. Root, Jr., Hunt-Spiller Mfg. Corp., Boston; L. W. Olson, Ohio Brass Co., Mansfield, Ohio.

Reports of the secretary treasurer were made at the meeting and the work of the various committees considered.

Alfred E. Howell, retiring member of the board of directors, was the guest of honor at a luncheon tendered him by the officers and board of directors of the American Foundrymen's association after their annual meeting. Both the luncheon and the business meeting were presided over by A. B. Root, Hunt-Spiller Corp., Boston, retiring president of the association. Officers and members of the board of directors are as follows: S. W. Utley, Detroit Steel Castings Co., Detroit, president; S. T. Johnston, S. Obermayer Co., Chicago, vice president; C. E. Hoyt, American Foundrymen's association, secretary; L. L. Anthes, Anthes Foundry, Ltd., Toronto, Ont.; T. S. Hammond, Whiting Corp., Harvey, Ill.; Alfred E. Howell, Somerville Stove Works, Somerville, N. J.; C. R. Messinger, Chain Belt Co., Milwaukee; Thomas W. Pangborn, Pangborn Corp., Hagerstown, Md.; G. H. Clamer, Ajax

ALFRED E. HOWELL

Metal Co., Philadelphia; John E. Galvin, Ohio Steel Foundry Co., Lima, O.; A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; R. A. Nourse, Nourse-Criley-Meehanite Co., Milwaukee; Wm. J. Nugent, Nugent Steel Castings Co., Chicago; Fred Erb, Erb-Joyce Foundry Co., Detroit; Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; L. W. Olson, Ohio Brass Co., Mansfield, O.; H. S. Simpson, National Engineering Co., Chicago.

Mr. Howell has had a long, distinguished and active connection with the American Foundrymen's association. In various capacities he has been a member of the board of directors since 1909 when he was elected vice president for the southern district. At that time the association observed four main districts, north, south, east and west and elected a vice president from each district. In the early days of his connection with the association and for several years afterward Mr. Howell was production manager with Phillips & Buttdorf, Nashville, Tenn. For the past five years he has been general manager of the Somerville Stove Works, Somerville, N. J.

He was elected president of the American Foundrymen's association for the term commencing October 1913 and ending September 1914 and since that time has been continuously re-elected to a position on the board of directors of the association. He was one of the charter members when the association decided to incorporate in 1916.

Mr. Howell was presented with an engraved ink stand and illuminated resolutions by the directors.

Tentative Standards Are Published

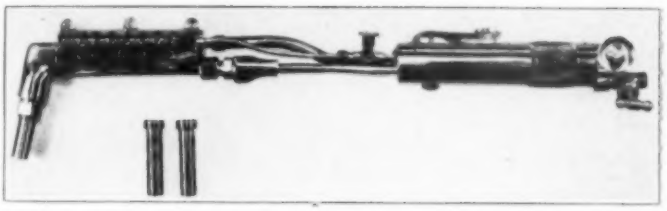
Tentative American standards for cast iron and steel flanges and fittings, and malleable cast iron screwed fittings for steam pressures recently have been published by the American Engineering Standards committee, under the sponsorship of the Heating and Piping Contractors' National association; Manufacturers' Standardization Society of Valve and Fittings Industry and the American Society of Mechanical Engineers. The standards are published in tentative form to invite discussion and criticism which should be sent to C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 West 39th street, New York. The tentative standards include those for cast iron screwed fittings for maximum working saturated steam pressures of 125 and 250 pounds per square inch; malleable iron screwed fittings for maximum working saturated steam pressure of 150 pounds per square inch; cast iron pipe flanges and flanged fittings for maximum working saturated steam pressure of 125 pounds per square inch; cast iron pipe flanges and flanged fittings for maximum working saturated steam pressure of 250 pounds per square inch; steel pipe flanges and fittings for maximum working saturated steam pressures from 250 to 1350 pounds.

Drives Molding Machine Electrically

The Howatt Machine Works, P. O. Box, 7612, Philadelphia, recently has introduced an electrically operated molding machine. The machine, which is shown in the accompanying illustration, is made in two sizes. The smaller machine is 60 inches long, 40 inches wide and weighs 4400 pounds, while the larger machine is 75 inches long, 55 inches wide and weighs 6000 pounds. The machines are equipped with two or three-horsepower motors and the power is transmitted by steel chains.

Several features are claimed for the machine. The molds are made by pressing the sand from below and above and by shaking. The cores are made at the same time. The motor operates through a rotating shaft and two eccentric disks to shake the sand in the flask. The sand is pressed with a special head which is located above the sand and is lifted and dropped several times during the shaking process. The patterns are loosened by vibration. The patterns are removed from the mold by a rotating shaft with two eccentrics.

The method of operation is as follows: A flask is placed on the machine and the sand is filled by a special apparatus. The machine then is started by a lever controlled by the operator. The molding plate then is lifted and dropped several times to distribute the sand evenly. During the shaking process the head presses the sand in the flask. The pressing head then moves back and the excess sand is stripped by hand. A vibrator loosens the patterns and the eccentrics remove them. The finished mold is taken out of the machine and the plate automatically returns to its position and the machine is ready for the next mold.



THE BURNER PREHEATS THE CUTTING OXYGEN

Designs Exhaust Fans

An exhaust fan which produces suction by centrifugal pressure has been placed on the market by the Macleod Co., Bogden street, Cincinnati. This type of fan has a projected inlet adjacent to the discharge outlet, instead of a center inlet. The material is discharged immediately without passing through the wheel or around the housing. With this feature, it is claimed that the wheel does not get out of balance or become clogged. The fans handle all materials that may be conveyed by air.

Suction is created by a centrifugal pressure, the air being forced centrifugally to the side of the housing opposite the wheel. The pressure of the air passing the projected inlet creates the suction. Pressures up to 12 inches may be obtained. The machines are adjustable and reversible. The machines are constructed almost entirely of steel.

Uses Illuminating Gas

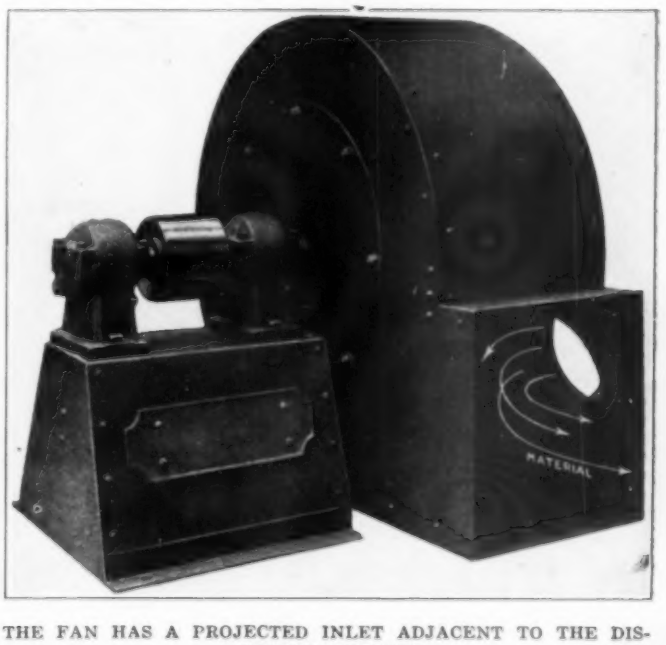
A cutting torch which uses illuminating and by-product gases recently has been placed on the market by the Alexander Milburn Co., Baltimore. The feature of this torch is the superheater which heats and expands the cutting oxygen and the preheating gases, raising the temperature of the cutting oxygen to approximately 100 degrees Cent. prior to combustion. This increases the temperature of the gases at the torch tip, increases the rate of flame propogation in the burning mixture and reduces the oxygen consumption it is claimed.

A bunsen burner contained within a torch burns illuminating gas, which heats the oxygen as it passes through a series of copper coils. The torch is constructed of bronze forgings and especially drawn tubing. The high pressure cutting oxygen is controlled by a thumb valve which remains fixed in either the open or closed position. The torch is 21 inches in length and is supplied with a complete range of tips for light, medium and heavy cutting. A view of the torch is shown in the accompanying illustration.

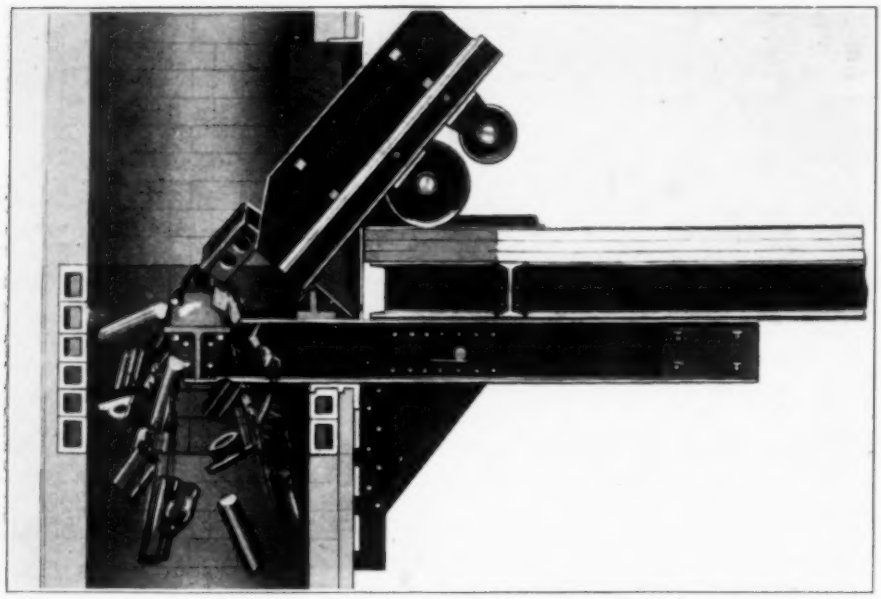
Addresses Philadelphians

Philadelphia Foundrymen's association held a meeting in that city on Dec. 7. Dr. Richard Moldenke, Wachtung, N. J., was the principal speaker at this monthly gathering.

THE MACHINE IS ENCLOSED IN A CAST IRON CASE



THE FAN HAS A PROJECTED INLET ADJACENT TO THE DISCHARGE OUTLET



THE LOAD MAY BE DUMPED BY LIFTING THE REAR END OF THE CAR

Spreads Charge Evenly in the Cupola

The Whiting Corp., Harvey, Ill., recently has introduced a cupola charger designed to spread the iron and coke evenly in the cupola. The charger consists of a cast iron distributing block bolted to one end of a steel I-beam. The beam is supported at the center by a pin and is counterweighted so that it may be moved in and out of the cupola by hand. Charges of iron and coke are carried separately in balanced cars which are equipped with roller bearings. Curved angles on the floor leading to the car wheel bumpers act as guides so that the car may be spotted easily in the door of the cupola. A steel plate charging floor is required.

When not in use the distributing beam is maintained at the vertical position. When the cupola is to be charged, the beam is pushed by hand into the horizontal position as shown in the accompanying illustration. The beam rotates about a pin at the center. The cars containing the coke and the iron are placed in position for dumping. The cars should be loaded in the yard so that the rear of the car is slightly heavier than the front. The car is dumped easily by lifting the rear end by hand as the main wheels strike the bumpers. The front legs of the car prevent its tipping over in the yard if unbalanced. The legs also permit charging as soon as they extend over the edge of the charging floor at the cupola door.

An air dump machine may be used where the charging floor is low. It is claimed that this charging unit gives an even distribution and saves the cupola lining. A safety feature also is included, since the charging door cannnot be lowered until the distributing beam has been swung into vertical position.

Vibrating Screen Has Ball Bearings

A ball bearing vibrating screen recently has been announced by the Link-Belt Co., 910 South Michigan avenue, Chicago. The screen, which is shown in the accompanying illustration, consists simply of a shaft which is driven at a suitable speed from any common source of power. The shaft is thrown out of balance by adjustable counterweights and thus imparts vibrations to the screen box on which it is mounted. The vibration is transmitted to the screen cloth, which is secured in the box under tension. The vibrating screen is made in the following sizes: 2 x 5 feet, 3 x 5 feet, 4 x 5 feet, 3 x 8 feet, and 4 x 8 feet. Each may be supplied with either one or two screening surfaces, giving wide application for materials of various sizes.

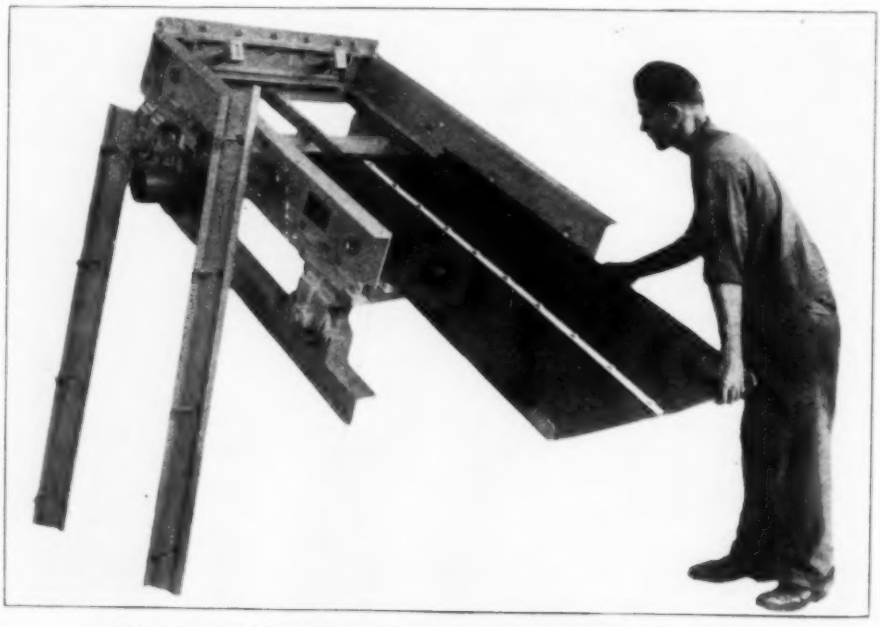
Screen cloth is placed upon the deck with the two longitudinal edges bent up. Binders are provided for the fine mesh cloths, for protection against tearing. The flanged clamp plates engage these binders or the bent edges of the cloth and by tightening the wing nuts on each side, the cloth may be stretched to the desired tension. A feed hopper attached to the receiving end of the screen box, vibrates with it and controls the feed and uniformly spreads the material over the screening surface of the machine.

Indiana FoundrymenMeet

At the Indiana State Foundrymen's convention held at Indianapolis on Nov. 22, the proposed unification of the Ohio and Indiana Foundrymen's associations was discussed. Letters are being mailed to members of the Indiana association to obtain their sentiments.

New Englanders Meet

New England Foundrymen's association held a meeting Dec. 8 at the Exchange club, Boston. D. M. Avey, editor, THE FOUNDRY, was the principal speaker. A nominating committee also was appointed to make nominations of officers for the next year.



THE SCREEN IS VIBRATED BY A SHAFT DRIVEN BY A MOTOR

Inventory Period Delays Sales

Many Inquiries Current, But Buyers Hold Off Closing Until After First of Year—Manufacturers of Equipment Continue Optimistic

SLACKENING of industry generally is reflected in the sale of foundry equipment. In practically all large distributing centers, foundrymen are holding off purchases of equipment until after the first of the year. However, the letup in industry for the inventory period in many cases has not affected the number of inquiries developing. The activity in this direction has led foundrymen to believe that business after the turn of the year will be highly satisfactory.

Foundry equipment sales are quiet in the Pittsburgh territory, but numerous inquiries are pending, to be placed shortly after the holidays and inventory periods. Miscellaneous equipment will probably be purchased by the Valley Mould & Iron Corp. and the Shenango Furnace Co. for ingot mold foundries at Hubbard, O., and Sharpsville, Pa., respectively.

Following rather brisk buying during the latter part of November, demand for foundry equipment since the first of December has been sluggish in the Eastern district. Inquiries are in fair volume, but at least a portion of these are for estimating next year's budgets, and orders in the main are slack. Featured among sales are two or three melting units for replacements.

The foundry equipment market in Chicago at this time is in the doldrums of the year's end. Sales are decidedly less than in recent months, and one company manufacturing sand preparing equipment reports that November was the worst month since October, 1924. Inquiries are scarce, and on many of those outstanding action is being deferred until 1927. A good portion of the inactivity is attributed to curtailed operations of automotive plants in the Detroit section.

Although the sales of some builders in the Cleveland territory have slackened slightly, other manufacturers have realized an increase in sales during the first half of the month. These manufacturers believe that the month will finish strong and that business after the first of the year will be good. Inquiries are plentiful. New England foundries are holding off equipment buying until after the first of the year.

Sales of foundry equipment in October showed a loss of 1 per cent compared with September and a loss of 5 per cent over October, 1925, according to a report of the Foundry Equipment Manufacturers' association, Cleveland. The value of sales in October was $396,354 as compared with $400,464 in September and $419,285 in October, 1925. Shipments gained 18 per cent in October over the preceding month, the value for October being $447,189 against $377,798 in September and $450,066 in October a year ago. Unfilled orders on Nov. 1 gained slightly, the values being $524,612 for Nov. 1, $522,273 on Oct. 1 and $518,794 for Nov. 1, 1925. Sales for the first ten months of the year are 15 per cent ahead of the corresponding period a year ago while shipments gained 18 per cent during the first ten months.

New England Market

Dust Arrester Equipment

Washburn shops, Worcester Polytechnic Institute, Worcester, Mass., from the Pangborn Corp., Hagerstown, Md.

Furnaces

New England Ship & Engine Co., Groton, Conn., cupola, spark arrester, etc. from the J. W. Paxson Co., Philadelphia.

Sandblast Equipment

Eastern Malleable Iron Co., Naugatuck, Conn., Babcock Printing Press Co., New London, Conn., from the Pangborn Corp., Hagerstown, Md.

Waterville Iron Works, Waterville, Me., from the J. W. Paxson Co., Philadelphia.

Sand Preparing Equipment

Davis & Furber Machine Co., North Andover, Mass., sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., through Alexander Haig, Boston.

Shakeout Equipment

General Electric Co., West Lynn, Mass., vibrator and shakeout equipment from the Stoney Foundry & Equipment Co., Cleveland.

Tumbling Barrels

H. B. Smith, Westfield, Mass., continuous tumbling barrel from the J. W. Paxson Co., Philadelphia.

New York Market

Furnaces

Thatcher Furnace Co., Newark, N. J., cupola, from the J. W. Paxson Co., Philadelphia.

Shakeout Equipment

Hanomag, Hannover-Linden, Germany, shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Molding Machines

Foran Foundry & Mfg. Co., Flemington, N. J., one machine from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sandblast Equipment

International Motor Co., Plainfield, N. J., Kensley-Milbourn & Co., Ltd., New York; from the Pangborn Corp., Hagerstown, Md.

Thomas Hines Co., Malone, N. Y., equipment; Gould Coupler Co., Depew, N. Y., sandblast table machine from the J. W. Paxson Co., Philadelphia.

Florence Pipe, Foundry & Machine Co., Florence, N. J., sandblast room.

Ladles

Chateauguay Ore & Iron Co., Standish, N. Y., one 10-ton bottom pour crane ladle; Thomas Hines Co., Malone, N. Y., ladle equipment, from the J. W. Paxson Co., Philadelphia.

Cleveland Market

Dust Arrester Equipment

Packard Motor Car Co., Detroit; from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Allied Cast Steel Co., Marion, O., one machine, from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sandblast Equipment

Ohio Brass Co., Mansfield, O., Central Steel Co., Massillon, O., Buick Motor Co., Flint, Mich., Whitehead & Kales Co., Detroit; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

Kenyon Industries, Ltd., St. Catherines, Ontario; Fittings, Ltd., Oshawa, Ontario; sand mixing machine from National Engineering Co., Chicago.

Shakeout Equipment

Humphreys Mfg. Co., Mansfield, O., Cadillac Motor Car Co., Detroit, vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Pittsburgh Market

Cranes

Witherow Steel Co., Neville Island, Pittsburgh, one 5-ton from the Bedford Foundry & Machine Co., Bedford, Ind.

Dust Arrester Equipment

Jones & Laughlin Steel Corp., Pittsburgh, Standard Engineering Co., Ellwood City, Pa., from the Pangborn Corp., Hagerstown, Md.

Furnaces

J. G. & W. Campbell Foundry Co., Butler, Pa., one cupola from the Whiting Corp., Harvey, Ill.

Ladles

Fairmount Mfg. Co., Fairmount, W. Va., three crane ladles from the J. S. McCormick Co., Pittsburgh.

Molding Machines

Reliance Steel Casting Co., Pittsburgh, two rollover machines; Weatherly Steel Casting Co., Weatherly, Pa., one machine; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Chicago Market

Core Ovens

Oklahoma Steel Castings Co., Tulsa, Okla., from the Swartwout Co., Cleveland.

Dust Arrester Equipment

Bucyrus Co., South Milwaukee, Wis.; Caterpillar Tractor Co., Peoria, Ill.; from the Pangborn Corp., Hagerstown, Md.

Sand Preparing Equipment

Arensen Foundry Co., Kenosha, Wis.; Union Malleable Iron Co., East Moline, Ill.; Oklahoma Steel Castings Co., Tulsa, Okla.; sand mixing machines from the National Engineering Co., Chicago.

Spring City Foundry Co., Waukesha, Wis., sand mixer and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., through Page & Ludwick, Chicago.

Jackson & Church Co., Saginaw, Mich., sand separator and blender from the Royer Foundry & Machine Co., through Alexander Haig, Boston.

Ladles

Keokuk Steel Castings Co., Keokuk, Iowa, one 7500-pound helical worm geared ladle from the Whiting Corp., Harvey, Ill.

Shakeout Equipment

Studebaker Corp., South Bend, Ind., three shakeout bails; Holmes Foundry Co., Port Huron, Mich., John Deere Tractor Co., Waterloo, Iowa, Holland Furnace Co., Holland, Mich., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Molding Machines

Deere & Co., Moline, Ill., vibrator molding machine from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Sandblast Equipment

Northwestern Malleable Iron Co., Milwaukee, Eureka Steel Range Co., O'Fallon, Ill., from the Pangborn Corp., Hagerstown, Md.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Lufkin Foundry Machine Co., Lufkin, Tex., has opened a sales office at Tulsa, Okla, in charge of W. W. Trout.

Richmond Hill Iron Foundry, Nineteenth avenue and 126th street, Richmond Hill, N. Y., will rebuild its burned foundry.

Walworth Alabama Co., Gadsden, Ala., is building a cleaning room 42x100 feet at its plant at Attalla, Ala.

Kilpatrick & Sons Foundry Co., St. Louis, will rebuild the burned portion of its foundry at Bulwer street and Carrie avenue.

Peerless Foundry Co., 1853 Ludlow street, Indianapolis, has let contract to W. A. Sides, 121 Garfield street, for a 1-story addition 67x85 feet.

Connecticut Foundry Co., Rocky Hill, Conn., has let contract to C. P. Waterman Inc., 43 Farmington avenue, Hartford, Conn., for a 1-story addition.

Emerson-Brantingham Corp., Rockford, Ill., manufacturer of agricultural implements will build a 1-story foundry 60x100 feet. Contract to O. C. Hitt, 1722 School street.

Boykin Machinery & Supply Co., Laurel and Second streets, Beaumont, Tex., has bought adjoining property and will build 1-story addition 75x200 feet early in 1927.

Southern Wheel Co., Atlanta, Ga., has let contract to A. Bentley & Sons, 201 Belmont avenue, for four buildings on Westwood avenue, Toledo, O.

American Steel Foundries, Chicago, has acquired the plant of the Verona Steel Castings Co., Verona, Pa., with equipment and inventory at an undisclosed consideration.

Trenton Brass & Machine Co., Dale and Prospect streets, Trenton, N. J., has let contract to R. T. Bowman Co., Broad Street Bank building, for a 1-story addition to its plant.

Stockham Pipe & Fittings Co., 4100 North Tenth avenue, Birmingham, Ala., manufacturer of cast iron pipe, valves and fittings, it building a large addition to its plant to increase production.

National Radiator Co., Robert S. Waters secretary, Central avenue, Johnstown, Pa., will build a foundry plant at New Castle, Pa., general contract to H. K. Ferguson Co., 3900 Euclid avenue, Cleveland.

Penn Brass & Bronze Works, 107 Dobbin street, Brooklyn, N. Y., is having plans drawn by Gustave Erda, 826 Manhattan avenue, New York, for a 2-story foundry 40x100 feet.

William H. Wilson Iron Works, Rochester, N. Y., has been incorporated with $50,000 capital to manufacture iron products by W. H. Wilson and E. Allen. J. F. Thomas, Rochester, is attorney.

Valley Mould & Iron Corp., Sharpsville, Pa., will build a $750,000 ingot mold plant on a 15-acre site adjoining the Hubbard works of the Youngstown Sheet & Tube Co., Hubbard, O.

Standard Foundry Co., Racine, Wis., is erecting a new foundry building parallel to its core building completed a year ago. The foundry will be 110x240 feet and have a capacity of 100 tons of castings daily. (Noted Oct. 15).

Shenango Furnace Co., Pittsburgh, is building a $1,000,000 foundry for the production of ingot molds at its blast furnace plant in Sharpsville, Pa. The foundry will employ 500 men and have a capacity of 25,000 tons a month.

Port Huron Corp. of Illinois, Chicago, has been incorporated with $1,000,000 capital to manufacture farm equipment, implements and machinery by Owen J. Stocking, Edward P. Brennan and Herbert N. Ewing. Gerald L. McMullen, 140 North Dearborn street, is correspondent.

Saco-Lowell Shops, Boston, with plants at Biddeford, Maine; Lowell, Mass.; Newton Upper Falls, Mass., has a new financing plan involving the issue of $500,000 of 5-year 7 per cent convertible notes. The Kitson plant at Lowell will be separated from the parent company as a subsidiary corporation to be known as the Kitson Machine Shop.

Wistrand Mfg. Co., Galva, Ill., a long-established industry will resume operations at once under the name of the Great Western Pattern & Mfg. Co. The company has been incorporated with $500,000 capital and new officers and directors have been elected. B. S. Barger, Casper, Wyo., has been elected president, R. M. Meisinger, vice president and general manager of manufacturing, and W. P. Matthews, Casper, Wyo., secretary-treasurer and general manager. A plant at Casper is being dismantled and equipment will be removed to the Galva plant. The former line of pumps and corn planters will be continued.

New Trade Publications

BELTING—A booklet by the Cleveland Oak Belting Co., Cleveland, covers the subject of industrial belting and contains a fund of engineering data relating to the subject.

ARC WELDERS—General Electric Co., Schenectody, N. Y., has issued a bulletin covering its large tank and pipe welders of various types. The devices are described in detail, with ample illustrations. Installations in operation are shown and descriptive matter explains fully the method of operation.

TRUCKS AND TRACTORS—Four bulletins have been issued by the Automatic Transportation Co. Inc., Buffalo, covering its elevating platform truck, tiering-lifting truck, three wheel tractor and locomotive crane truck. Specifications for each type are given.

HOISTS—Wright Mfg. Co., Lisbon, O., has issued a comprehensive catalog of its chain hoists, trolleys, hand cranes and allied equipment. It is illustrated with halftones and line drawings giving dimensions and clearances of its products. It is of value to engineers, architects and superintendents.

HEAT TREATMENT—A bulletin by the Stanley P. Rockwell Co., Hartford, Conn., gives an explanation why steel cracks in heat treatment, due to the difference of condition in the outer and inner portions. Application of methods of heat measurement to equalize temperature throughout the piece is described.

INSULATING BRICK—A bulletin by the Celite Products Co., Los Angeles, describes four types of brick produced by this company, adapted to various ranges of temperature and uses. It is illustrated to show proper method of using in various installations.

AUTOMATIC STOKERS—Joseph Harrington Co., Harvey, Ill., has issued a catalog describing its automatic mechanical stoker for small boilers, 40 to 250 rated horsepower for heating or power production. Numerous installations are shown in halftone and blueprints are given of construction of various types of furnaces.

You Can't afford Defective Castings

In these days of keen competition among brass foundries, many orders must be taken at a slight margin of profit.

And you *can* make a profit, provided you can figure on getting Perfect Castings.

But unfortunately, if you use scrap or "thrown-together" ingot, you *can't* come out right more than half the time because you don't know, without expensive analysis, what you are putting into your castings. Blow holes and hard spots will appear often and you'll get a high percentage of defectives.

If you use Ajax Process Brass and Bronze Ingots, you can bid on jobs with certainty, and assure yourself a definite profit because they are absolutely sure to produce Perfect Castings.

Ajax Process Ingots are made from thoroughly refined metal, and are guaranteed to be true to specified formula. Its a mark of distinction to tell your customers: We use AJAX PROCESS INGOTS.

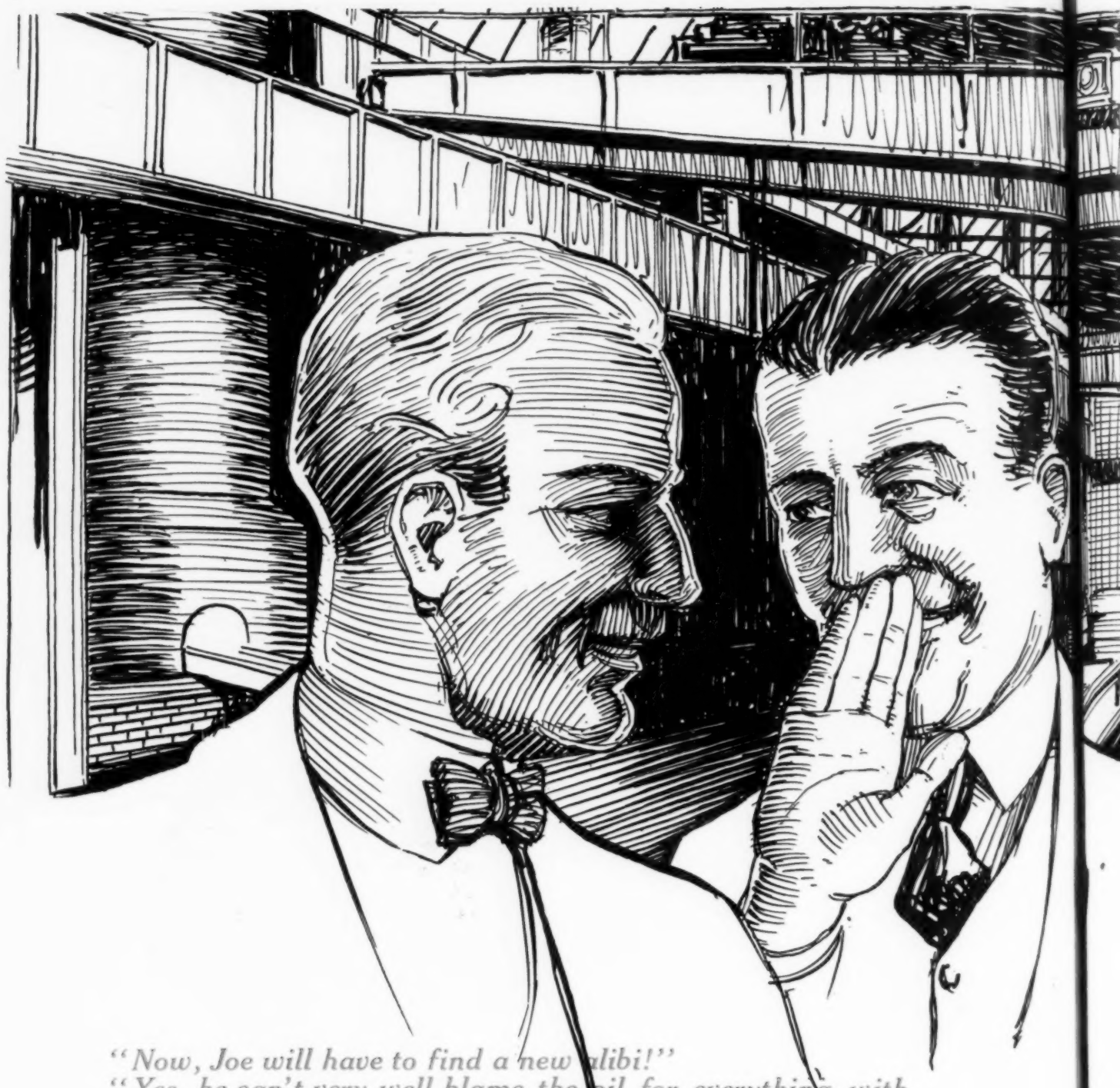
The Ajax Metal Company

ESTABLISHED 1880

PHILADELPHIA

AJAX PROCESS INGOTS

Also makers of Ajax-Wyatt Electric Furnaces

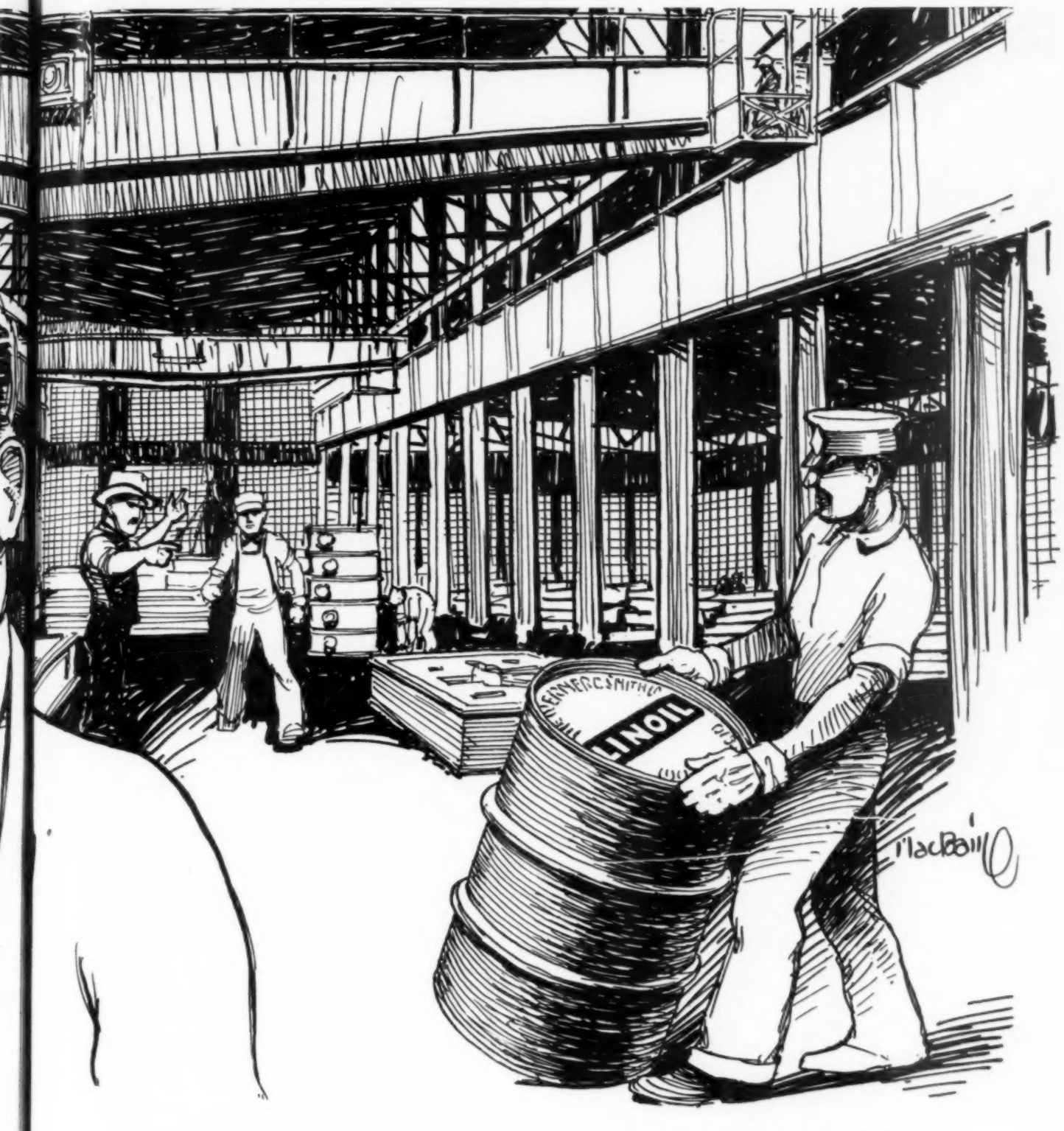


"Now, Joe will have to find a new alibi!"
"Yes, he can't very well blame the oil for everything with LINOIL on the job. From my knowledge of LINOIL, however, he's going to have lots less trouble out here."

Modern foundrymen know that trouble is much more costly than good core oil. They know no core oil can be good for their purpose that does not maintain absolute uniformity. They know that Linoil is not only the last word in core oil efficiency but that it is absolutely uniform year after year. That is why so

THE WERNER G.

ATLANTA—926 Atlantic Trust Bldg.
BOSTON—Mass. Trust Bldg.
BUFFALO, N. Y.—85 Huntington Ave. (Crescent 5229)
CHICAGO—327 So. La Salle St.
DAYTON—28 Marie Ave.
DETROIT—3300 Chicago Blvd. (Garfield 8794)
CLEVELAND—



many big foundries spend so little effort in chasing the will-o'-the-wisp of cheap buying. They find it far better business to standardize on the logical oil, knowing that the price is always fair and the quality and uniformity always dependable. Whether you are a large or small user of core oil it will pay *you* to standardize on Linoil.

SMITH COMPANY

2191 W. 110th St.

INDIANAPOLIS—114 S. Alabama St.
LOS ANGELES—255 East 9th St.

PHILADELPHIA—704 Com'l Bldg.
SAN FRANCISCO—537 Second St.
WAUWATOSA, WIS.—405 Church St.

Truscon Core Racks are adaptable to the most modern methods of conveying. Illustration shows lift-truck manipulation of loaded Truscon Core Racks.

Note the sturdy angle iron construction, the extra heavy braced lower platform and the adjustable feature of the trays in the Truscon Core Rack.

Products Plus a Service

Truscon Foundry Products are designed to give longer and more efficient service than the old type equipment which they are rapidly supplanting in leading foundries everywhere.

Truscon equipment not only has the durability and strength of steel, but in each instance performs its task at less cost to the foundry. Unbreakable and non-burning materials mean elimination of replacement costs and of expensive tie-ups.

Your special requirements can be met by Truscon. Our service of suggestion, design and estimate is yours for the asking and without obligation. The coupon will bring you an interesting illustrated catalog showing what Truscon has done for modern foundries.

Write for catalog

TRUSCON STEEL COMPANY, Youngstown, Ohio

Special Foundry Products Representatives in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis and Cincinnati.

TRUSCON PRODUCTS FOR THE FOUNDRY

Truscon Flasks in use in Madison Foundry.

Flasks That Ask No Favors

Truscon Alloy Steel Flasks meet the hardest condition of usage in foundries. They are built that way—to give long service and turn out the highest grade of castings.

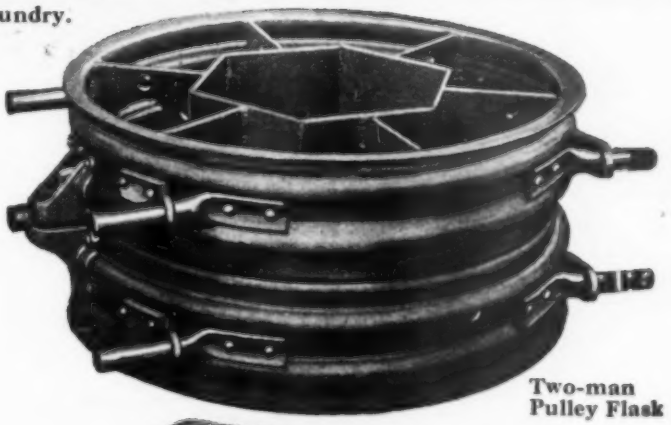
Every Truscon Flask is built for its particular job and designed to secure economy of time and man-power. No task of casting is too large or too small for a Truscon Flask to do it better.

Whatever you cast get in touch with Truscon for suggestions and estimates on Truscon Alloy Steel Flasks. The coupon will bring you a completely illustrated catalog of Truscon Foundry Flasks.

Write for catalog

TRUSCON STEEL COMPANY, Youngstown, Ohio

Special Foundry Flask Representatives in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis and Cincinnati.



Two-man Pulley Flask

Flask for Jobbing Work.

TRUSCON ALLOY STEEL FOUNDRY FLASKS

TRUSCON STEEL COMPANY
Youngstown, Ohio, U. S. A.

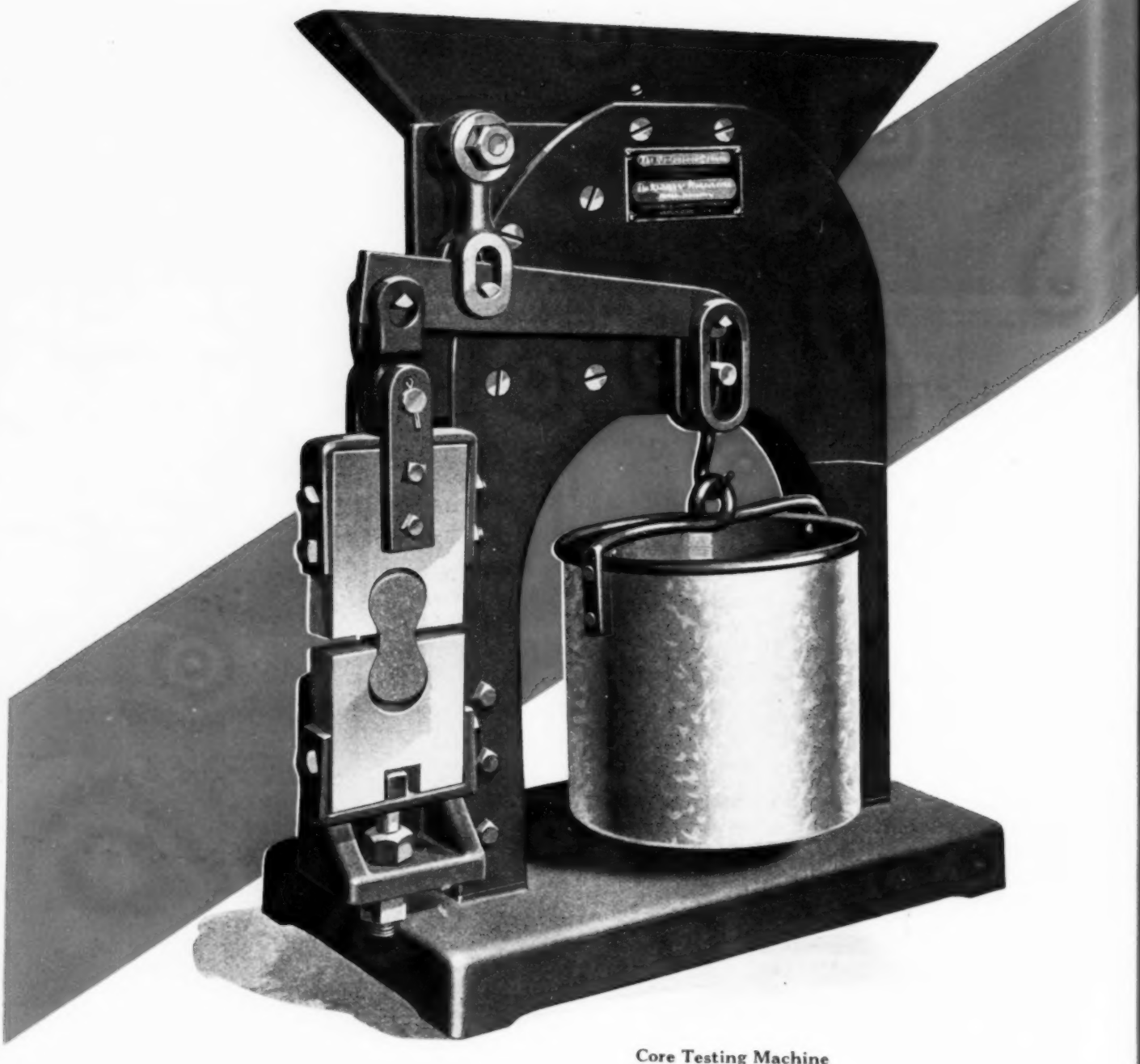
Send me catalog and complete details on
Truscon Alloy Steel Flasks
Truscon Products for the Foundry

Name .....

Address .....

Fdry. 12-15-26

It is the



Core Testing Machine

KELLOGG'S

LINSEED OIL FILM
that makes strong cores

LINSEED oil has the property of drying to a tough elastic film which in core oil binds the grains of sand together. Other vegetable oils have this property to a less degree. Fish oil still less. Mineral oils do not have it at all.

All Kellogg Core Oils have the Linseed Oil Base.

Core Oil Department

Spencer Kellogg and Sons, Inc.

BUFFALO, N. Y.

Minneapolis	Cleveland	Kansas City
Cincinnati	Buffalo	Philadelphia
Detroit	Boston	St. Louis
Chicago	New York City	Grand Rapids
Columbus, O.	Springfield, O.	Milwaukee

Kellogg's 7 Brands

Kelloil
Gold Bond XX
Cylinder Core Special
Gold Bond
Radiation Special
No. 10
Skasco

All these are linseed base core oils. We are the only manufacturers of core oils who make linseed oil.

CORE OILS

5 Months, 23 Hours a Day

That's how Pangborn Room Sand-Blast stands the gaff under hard constant duty. It can be depended on for the peak load, and day and night when necessary.

More than a year, on an 8-hour day basis, of just steady, dependable work, with continuous output at low cost. That is what the American Radiator Co. demanded and got.

It's typical of Pangborn performance that saves time, temper and sand-blast grief and it's also why 60% of our annual volume is "repeat" business.

Pangborn Quality gives you economical sand-blasting—not just a sand-blast.

Ask for a Condensed Catalog of Complete Sand-Blast Equipment. Then let our District Sales Engineers talk with you about the type that interests you—It's no obligation.

A Pangborn Twin Table-Room Sand-Blast Cleaning 96 tons large Furnace castings daily. Tables at floor level.

Pangborn Sand-Blasts
and Dust Suppression Equipment

Distributors for "Certified" Steel Abrasives

Not a Single Shut-down.

Three thousand working hours without a shut-down for repairs or adjustment.

That's the experience of the Company who gave us the statement on the opposite page, of his Pangborn Room operation.

No stops, no troubles; few parts, simple and easy to get at and a "hog" for work.

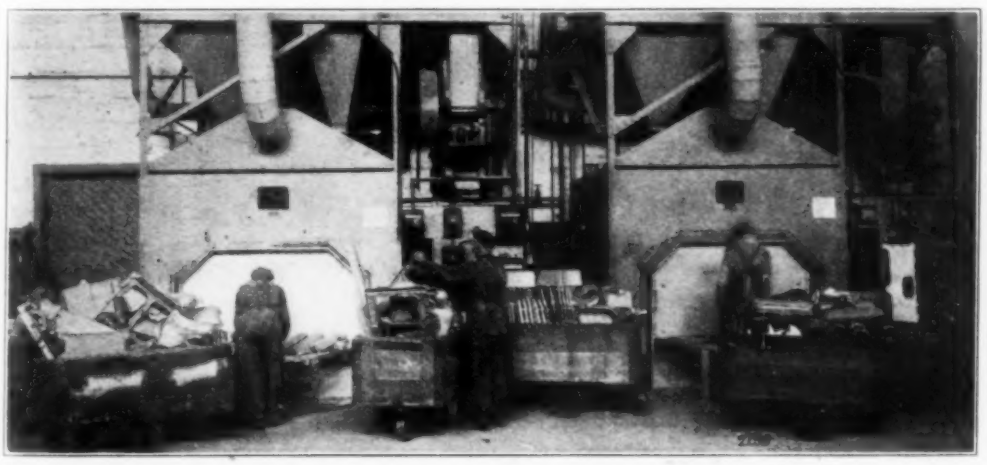
In Grey Iron, Malleable, Steel Foundries and Enameling Plants Pangborn Sand-Blast and Dust Suppression Equipment is famous for day-in and day-out service.

It's the sand-blast you clean with instead of tinker with.

PANGBORN CORPORATION
Hagerstown, Maryland

District Offices

CHICAGO	Railway Exchange Building
CLEVELAND	Penton Building
DETROIT	General Motors Building
PHILADELPHIA	1940 W. Ontario St.
PITTSBURGH	Chamber of Commerce Bldg.
ROCHESTER, N. Y.	161 Scottsville Road
SPRINGFIELD, MASS.	53 G'enwood Circle
ST. LOUIS	1 Pitman Place

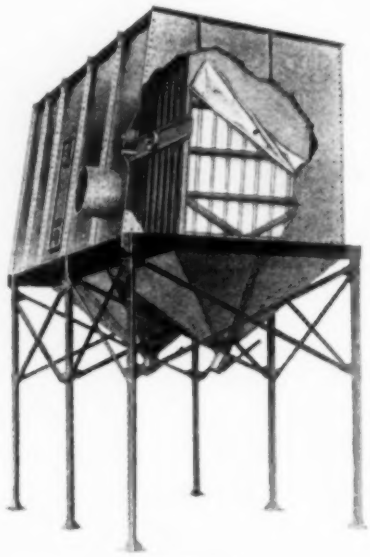


A Pangborn
Another Pangborn Twin Table-Room Sand-Blast cleaning stove castings as fast as three men can load and unload the work.

Pangborn Sand-Blasts
and Dust Suppression Equipment

Distributors for "Certified" Steel Abrasives

The New American



The New American Dust Arrester

The outstanding features of the Newly Designed Dust Arrester are:

1. CORRECT SHAPE: Screen of proper size to cover area of Air Penetration only.
2. COMPACTNESS: More square feet of Screen Area per cubic foot of Arrester Displacement.
3. LOW MAINTENANCE: Individual Screens easily removed.
4. WEATHERPROOF HOUSING: The only Dust Collector with Housing manufactured from Hot Galvanized Sheets.

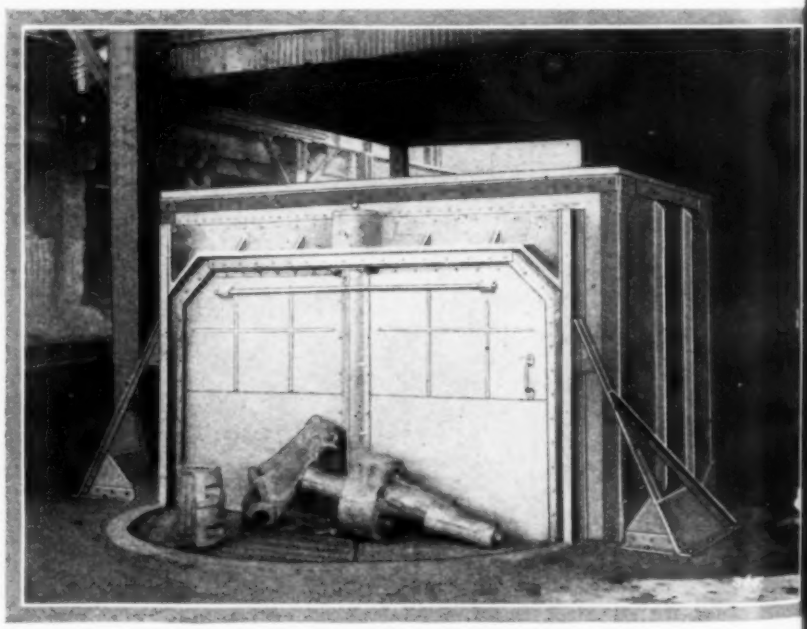
The American Molder

THE EFFICIENCY and low maintenance of this equipment are assured by [1] Positive Ventilation. [2] a minimum number of moving parts. [3] Shallow Pit Construction. [4] Hyatt Equipped Head and Foot Bearings. [5] Heavy Steel-Plate Panel Construction clamped to a Structural Steel Frame. [6] Perfect Abrasive Separation. [7] Single Control Operating Valve. [8] Valveless Mixing Chamber.

Perfect Abrasive Separation

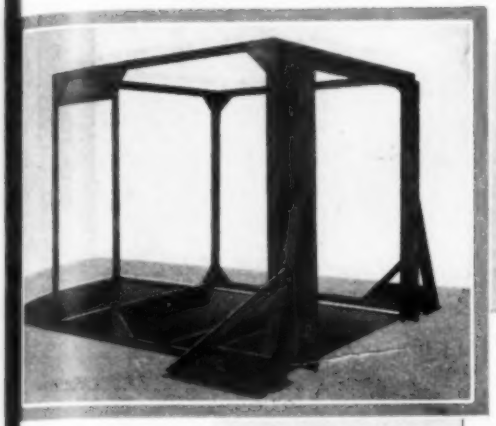
All sand, wires, cores, etc., dropping through the Floor Perforations enter a Transfer Pan. An oscillating movement transmitted to this pan conducts the contents into a throat where air at high velocity scrubs out the dust. A screen then removes all refuse and permits the air-scrubbed abrasive to fall into the Sand Blast Tank below for re-use.

THE AMERICAN FOUNDRY EQUIPMENT CO.
400 Byrkit Ave., Mishawaka, Ind.

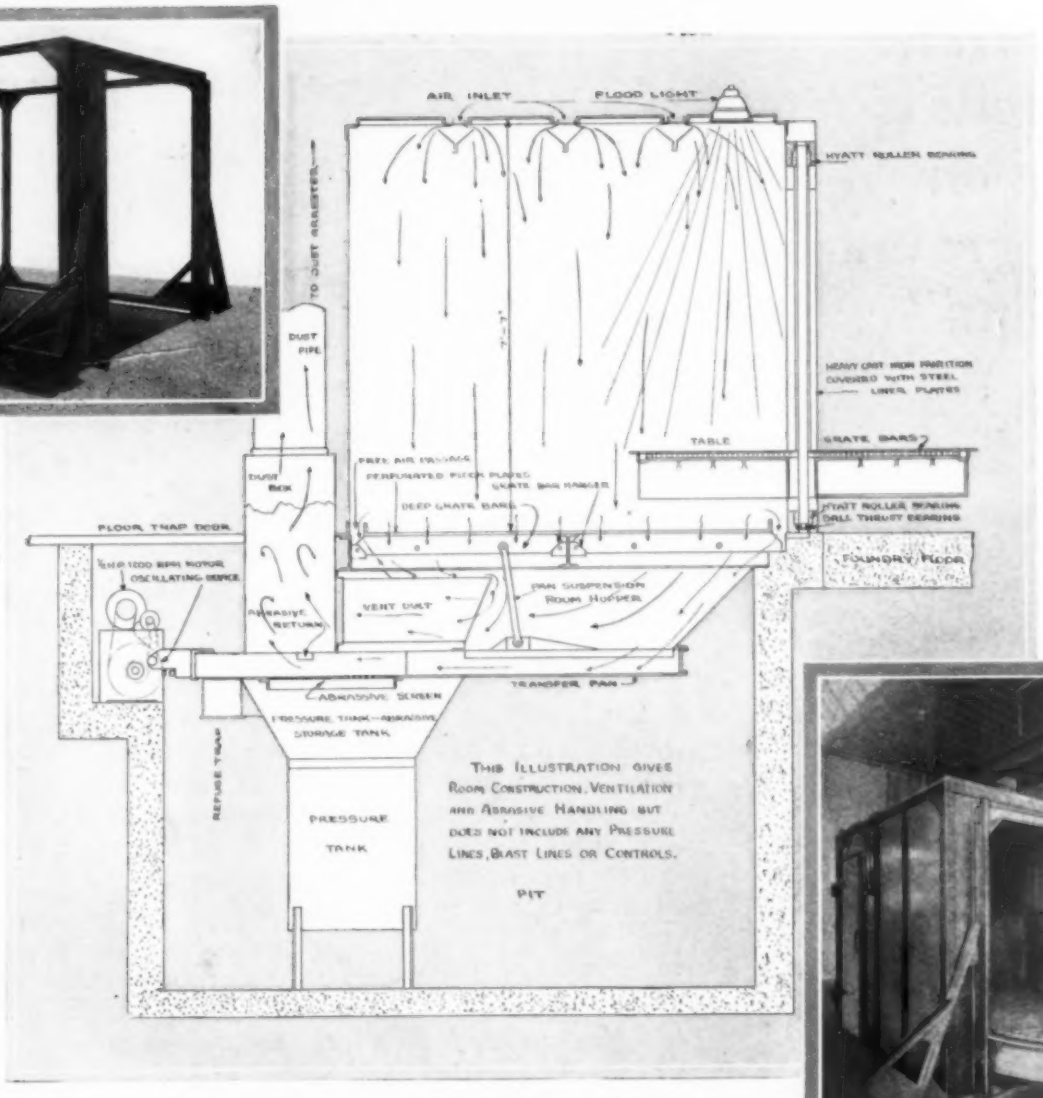


An 8-ft. Rotary Table Room, recently installed in a large Steel Foundry.

Down-Draft Blast Room
for Sand or Shot Blast



The framework of the New American Room is a heavy steel structure, and supports the 1/16 inch steel-plate wall panels which are secured to the frame by a novel clamping device.



Pictured above is an American Down-Draft Room with Rotary Table, a very popular design, obtainable in from 6 to 10 ft. diameters. This Room can also be furnished without the Rotary Table.

Especially Adapted for Extremely Dirty Cleaning

The New American Down-Draft Blast Room, as illustrated above, is particularly adapted for extremely dirty cleaning. We also build a still more simple design of Down-Draft Room with but one moving part for Scaling Work, Secondary Cleaning, Enamelling Plants and Heat Treating Shops.

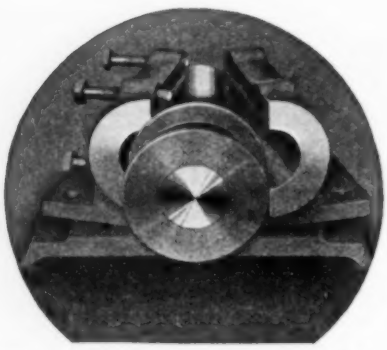
The American Line

{ The American Line for Foundry Efficiency consists of Sand-Cutting Machines, Sand Blast Equipment, Dust Arresters, "Hammer" Core Machines, Aluminum Taper "Strip" Flasks and Adjustable Steel Pouring Jackets; Pattern Mounting Compound }

Sand Paddled 640

"The Mixer that puts a coat on every grain of sand"

For Fast and Thorough Core and Facing Sand mixing—Use the "Standard"



The vertical split bearings, with easily removable die cast bushings.

THE Standard has 32 paddles alternately right and left hand, one half of them longer and larger than the others. The longer paddles work the sand toward the center of machine and discharge the batch when gate is opened, while the others work it way from center. At a shaft speed of 20 R.P.M., there are 640 paddle strokes per minute mixing the batch with the most intensive thoroness in quick time.

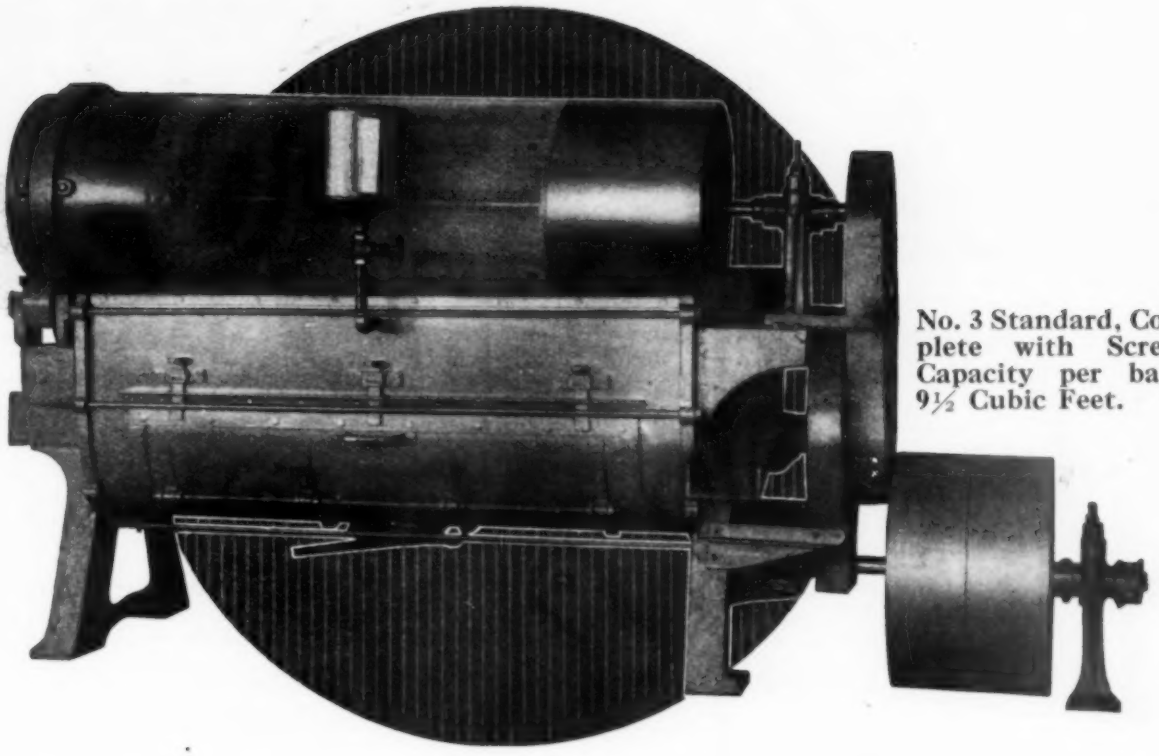
The following tests prove how thoroly this machine mixes: The machine standing idle, black sand was placed in one end and white sand in the other end. The machine was started, and at the end of two minutes, the black and white sands had blended into one uniform color. Then a handful of marbles was thrown in one end of the mixer. After two minutes the mixer was stopped and the marbles were found distributed the *full length* of the mixer.

These tests may be repeated on any Standard Mixer. Do you appreciate the efficiency they reveal?

The Standard Sand

5151 St. Clair Ave. N. E.

Times Per Minute



No. 3 Standard, Complete with Screen. Capacity per batch 9½ Cubic Feet.

"Standard" Construction Assures Long Life and Low Maintenance Cost

AN outstanding feature of the Standard Sand Mixer is the paddle shaft vertical split bearings with their die cast bushings, shown on opposite page. Bushings can be renewed without removing a gear, pulley or collar from the shaft. The same type of bearing is used on the driving countershaft.

The paddle tips are easily replaced, and are adjustable. They are made of "Feralum" an extremely durable abrasive metal which will outwear any other metal known.

The bearings of the screen trunnion rolls have bronze bushings which can be renewed without even a wrench. All that is needed is to raise the screen clear of the trunnion rolls, slip out the old bushings, and slide in the new ones. The outside of these bushings are square, and drop into a square slot milled in the retainer.

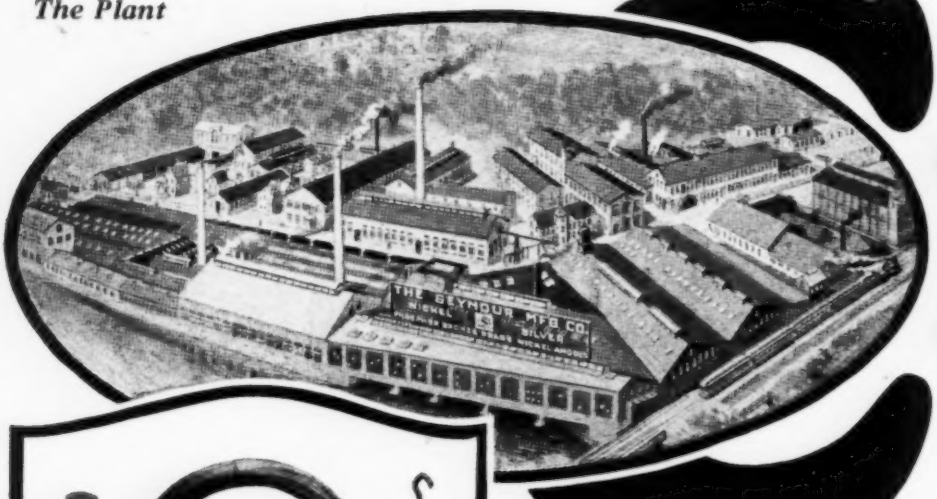
The maintenance man will at once see the advantage of Standard design in making repairs.

You can't go wrong on a Standard. For 25 years, Standards have been money-makers from the day they were installed.

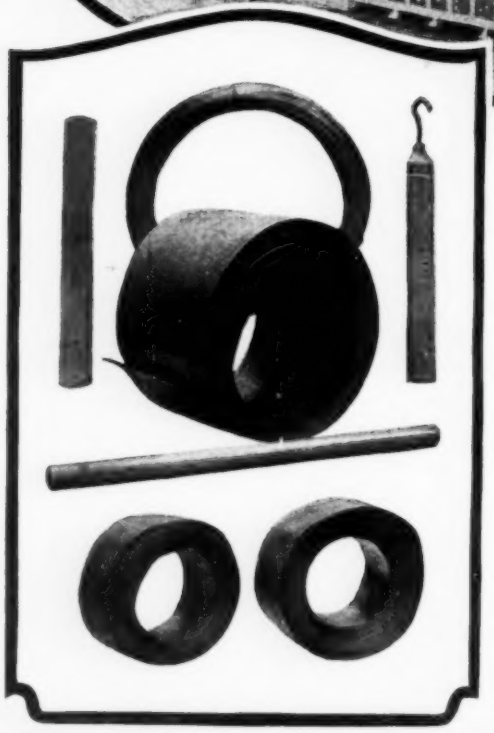
& Machine Company

CLEVELAND, OHIO

The Plant



Cru



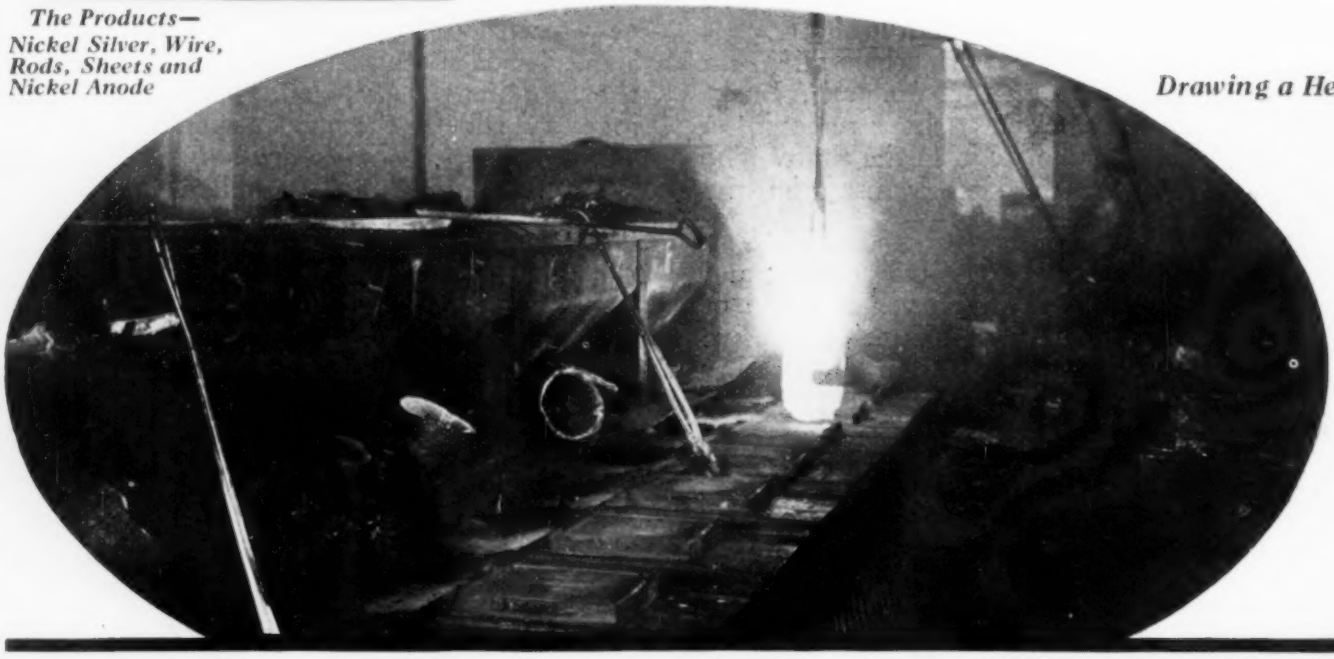
*The Products—
Nickel Silver, Wire, Rods, Sheets and Nickel Anode*

FOR almost a half century, The Seymour Manufacturing Co. has been noted for the uniformly high quality of its Nickel Silver.

From the casting of the bar, to the final finishing operation, the most painstaking care has been necessary to maintain such a position in the industry.

During this half century, The Seymour Manufacturing Co. has depended upon crucibles for the all important first step of melting.

Drawing a Heat



AGE ADAPTABILITY

cibles

NICKEL SILVER presents one of the most difficult problems, from the standpoint of melting, of any of the non-ferrous alloys.

Requiring as it does, temperatures exceeding 2250 degrees Fahrenheit, and being sensitive to oxidation and slag inclusions, the container in which it is melted becomes all important.

The service is so severe that only the high standards maintained by producers of crucibles, both as to materials and methods of manufacture, make it possible to handle the melting of this important alloy without prohibitive expense.

The illustrations show Nickel Silver melting and pouring scenes at the plant of The Seymour Manufacturing Co.—users of crucibles in the severest service for almost fifty years, millions of pounds being cast annually.

Ross-Tacony Crucible Company
Tacony, Phila., Pa.

Vesuvius Crucible Company
Swissvale, Pa.

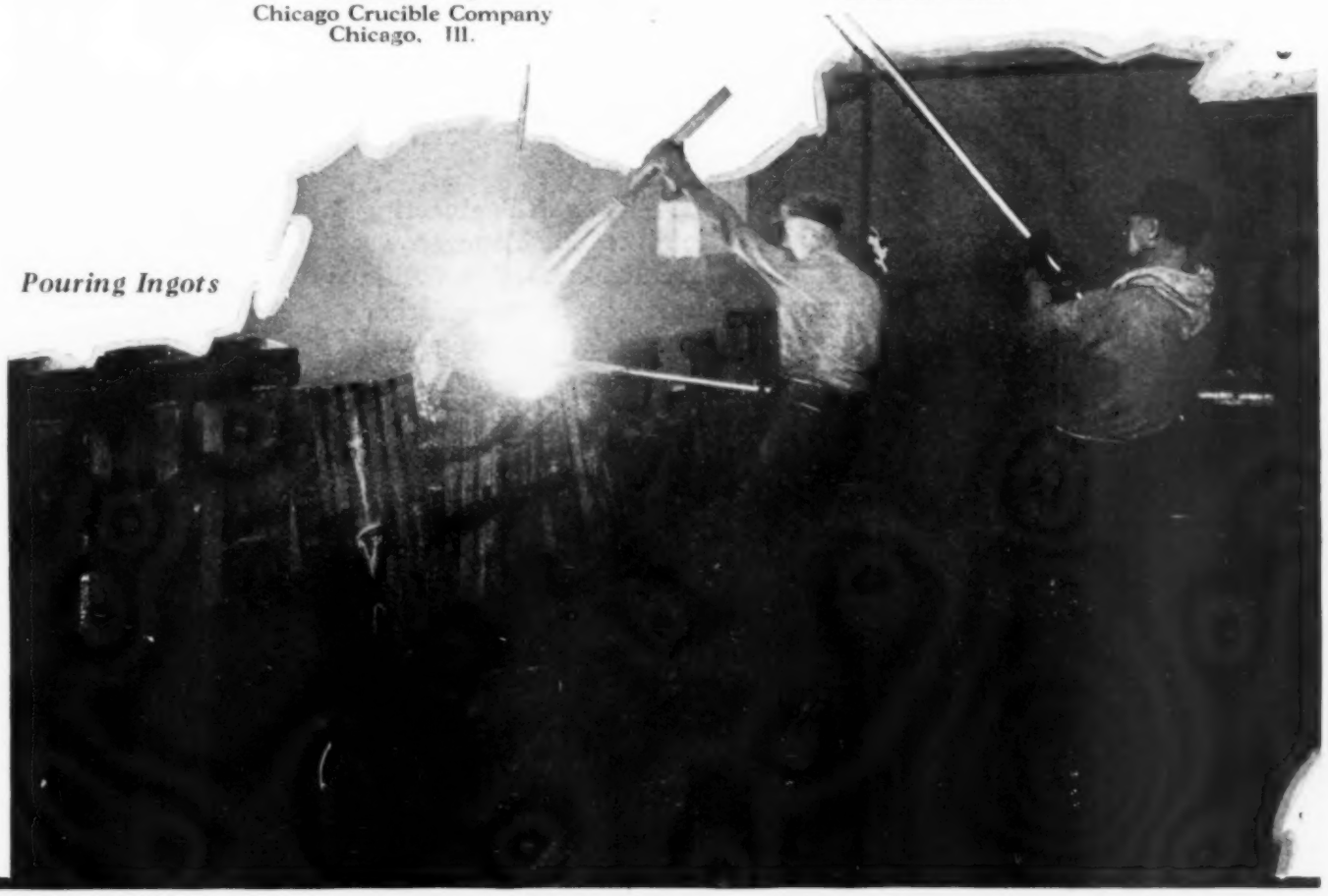
Jonathan Bartley Crucible Company
Trenton, N. J.

Chicago Crucible Company
Chicago, Ill.

Joseph Dixon Crucible Company
Jersey City, N. J.

Lava Crucible Company of Pittsburgh
Pittsburgh, Pa.

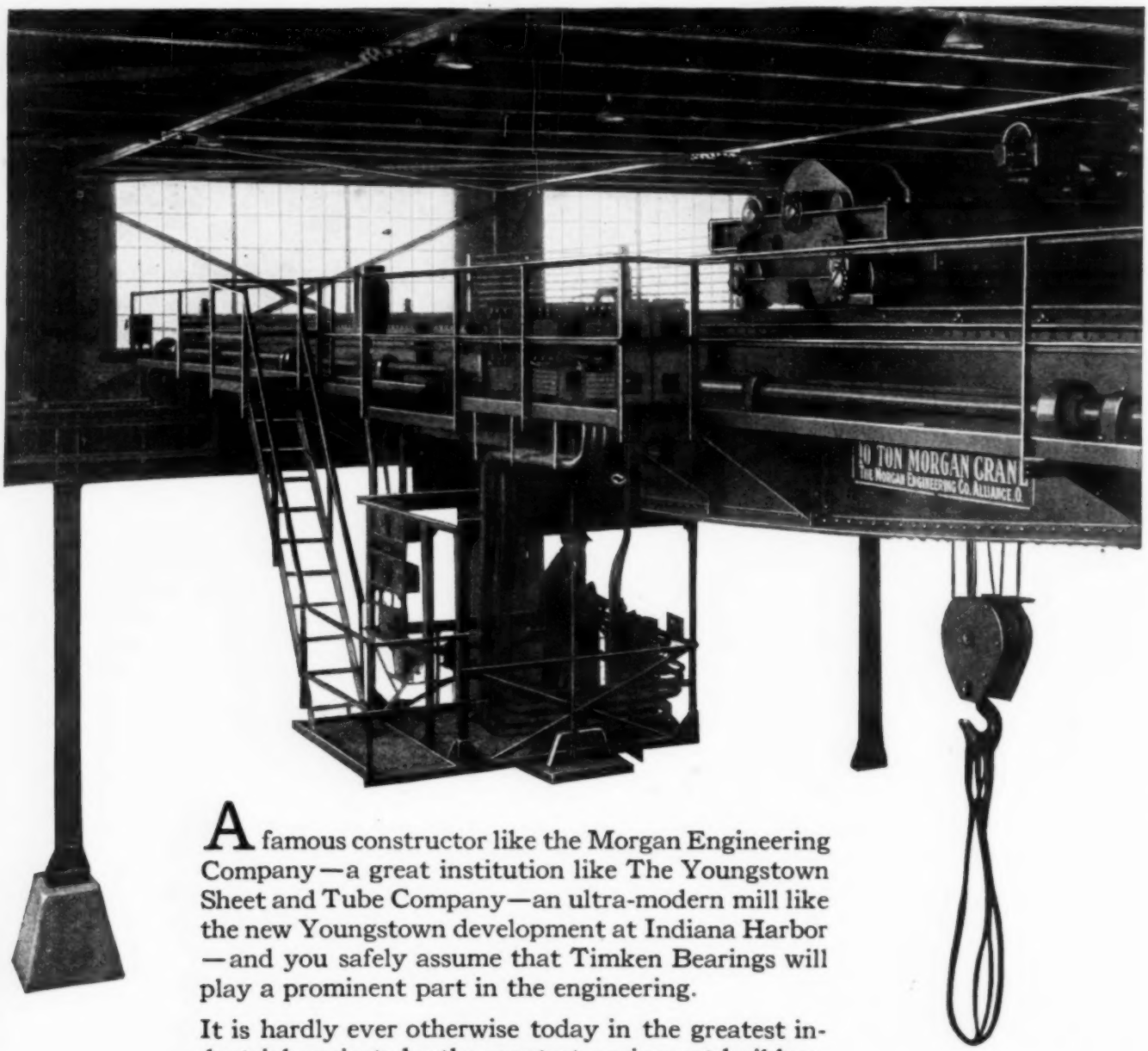
Naugatuck Valley Crucible Company
Shelton, Conn.



Pouring Ingots

RELIABILITY ECONOMY

Morgan—Youngstown—Timken



A famous constructor like the Morgan Engineering Company—a great institution like The Youngstown Sheet and Tube Company—an ultra-modern mill like the new Youngstown development at Indiana Harbor—and you safely assume that Timken Bearings will play a prominent part in the engineering.

It is hardly ever otherwise today in the greatest industrial projects by the greatest equipment builders, for the greatest machinery users.

Throughout all the Morgan cranes in this new mill, Timken Bearings are used to improve design and assembly, to save power and lubricant, to increase acceleration, daily capacity, and endurance. Timken economies could hardly have better sponsors than Morgan and Youngstown.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

Technical information regarding bearing sizes and their mountings can be secured from The Timken Roller Bearing Service & Sales Company's Branches located in the following cities: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, Newark, New York, Omaha, Philadelphia, Pittsburgh, Richmond, St. Louis, San Francisco, Seattle, Toronto, Winnipeg

TIMKEN *Tapered Roller* **BEARINGS**

YOU CAN GET

SAND-BLAST ABRASIVES

that cost only

Half as much as Sand

per ton of Castings cleaned!

They are

Certified Steel Abrasives

COPYRIGHTED 1925 PITTSBURGH CRUSHED STEEL CO.

Angular Steel Grit
Samson Steel Shot

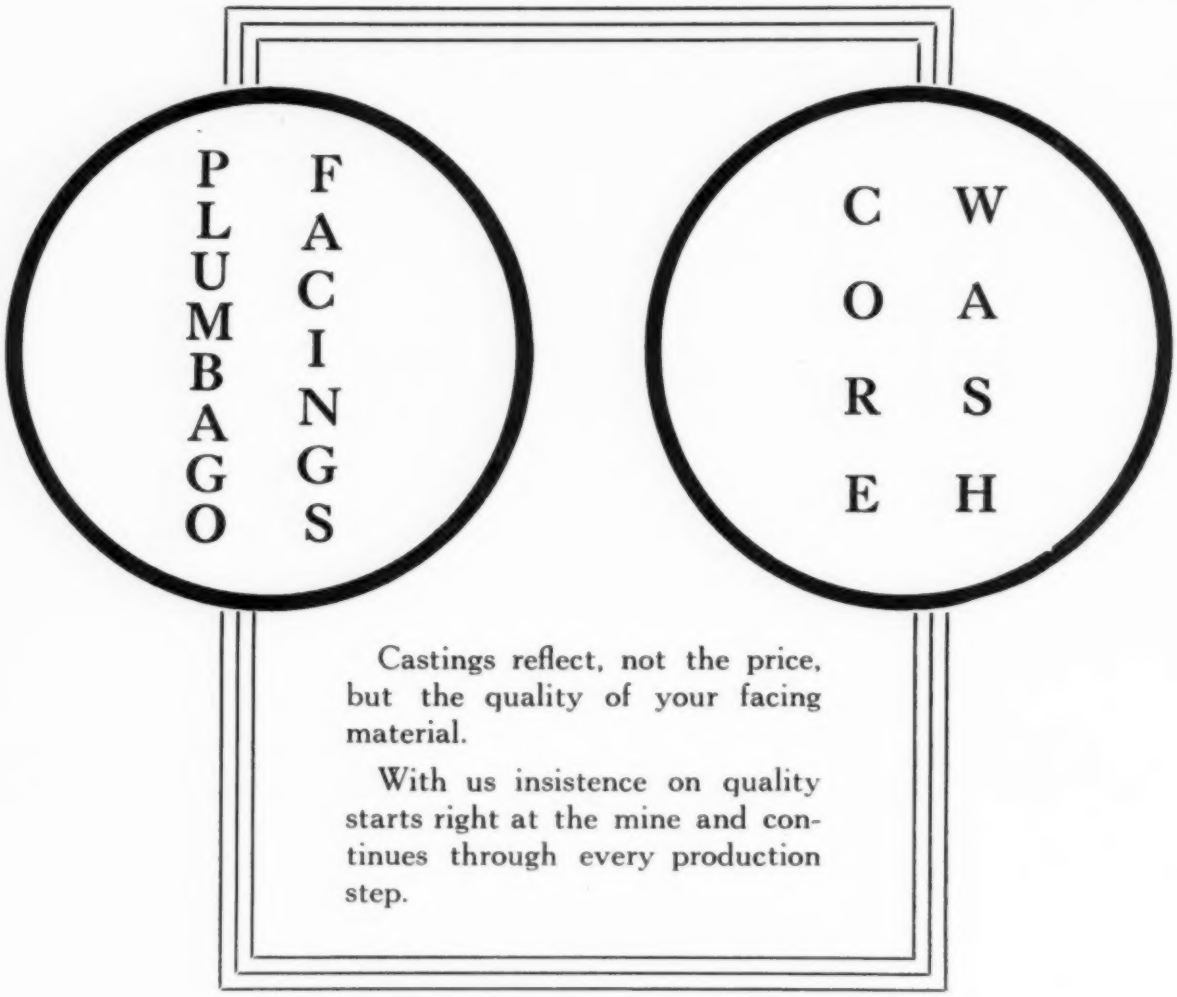
It's all you want to know about Abrasives

Manufactured only by:

PITTSBURGH CRUSHED STEEL CO.
Pittsburgh, Pa.

STEEL SHOT & GRIT CO.
Amesbury, Mass.

Certified Steel Abrasive is recommended by all leading Sand-Blast Manufacturers


PLUMBAGO FACINGS
CORE WASH
Castings reflect, not the price, but the quality of your facing material.
With us insistence on quality starts right at the mine and continues through every production step.

Facings that are Unusual in Heat Resistance

With them you can rub or brush a heat resisting skin on your mould, making a clean, smooth and attractive casting. You will save hours of cleaning and chipping.

You can try a barrel at our expense, i. e. if its performance does not make good *all* our claims, it can be returned to us at our expense.

There's no better time than *now* to take advantage of this offer. You have nothing to lose and much to gain.

GEORGE F. PETTINOS

1206 Locust Street, Philadelphia, Pa.

Boston Newark Erie Pittsburgh San Francisco Montreal

GEORGE F. PETTINOS — SANDS AND SUPPLIES — PLUMBAGO FACINGS

Leadership!

1874 SLYBLAST 1927

53 years experience in the manufacture of Foundry Cleaning Room Equipment . . . Many hundreds of cleaning room problems solved by our Engineers . . . Constant research and invention by our Engineering Department.

Those are reasons why we say *write to headquarters* when you need information about equipment for your cleaning room. You will be given facts based upon sound experience.

Complete!

Sandblast Equipment
Rooms
Cabinets
Tilted Mills
Rotary Tables
Pressure Tanks

Tumbling Mills

Dust Arresters

Brass Cinder Mills

Iron Cinder Mills

During the year just coming to a close, Sly Engineers have made remarkable strides forward—our most notable achievements are the *Continuous* Dust Arrester, the *Continuous* Sandblast Tank, and the Positive pressure Rotary Table. All of these inventions mean a lower production cost for you.

We take this occasion to heartily thank our friends, the foundrymen for their patronage. In the future as in the past; no effort will be spared to render a service and produce equipment that will merit your continued patronage.

The W. W. Sly Manufacturing Company
Cleveland, Ohio

Branches in Principal Cities

SLYBLAST

for Sandblast, Shotblast, Gritblast

KORDEK

Reg. U. S. Pat. Off.

A Foundry Necessity that assures Quality and Economy

What It Is:

KORDEK is the highest grade dry vegetable core bond. Great binding strength, combined with utmost reliability makes it extremely economical. You will find it, always, absolutely uniform and 100% efficient.

What It Does:

KORDEK produces castings of the highest grade with the smallest percentage of blowholes and imperfections—

makes cores that have sharp edges and keep them—

bakes in the shortest time—

bakes at the lowest temperature—

increases in strength while baking—

stands up when metal is poured—

leaves a clean core box—

breaks out of castings with greatest ease—

gives off the least smoke and gas—

may be mixed in large quantities, and used as needed—

CORN PRODUCTS REFINING CO.

17 Battery Place **New York, N.Y.**

KORDEK

Reg. U. S. Pat. Off.

"Haven't heard you kick about costs lately"

says the "Super" to the "P. S."

When the Plant Superintendent drops in to see the Superintendent of the pattern shop, he is apt to be greeted with such a remark, because the "Super" is utilizing every last inch of Sugar Pine stock, without waste or loss.

Every dollar spent in buying Sugar Pine for the pattern shop becomes a permanent investment in patterns. This genuine white pine cuts easily and true to line, either with or across the grain, because of the unvarying softness of texture, thus expediting pattern making, while eliminating waste in operation.

With saw, chisel, plane, or knife working with Sugar Pine is easy and time-saving. The "corky" texture permits nails to be snappily driven, anywhere, as close to edges as you please, without fear of splitting.

When small pattern sections must be glued, —that's another place where Sugar Pine shows its class. The glue spreads evenly, and the two pieces stick together as though they were one.

Finally, when the pattern is painted comes the last, but not the least, satisfaction that the wood is Sugar Pine, for the brush moves easily, the paint flows smoothly, and is readily absorbed, to be retained for all time.

Order a small supply of Sugar Pine and try it, with tools, glue, and paint—then you'll buy more. You will find that Sugar Pine is the superior pattern wood and keeps pattern shop costs at the lowest point.

CALIFORNIA WHITE AND SUGAR PINE MANUFACTURERS ASSOCIATION

63 662 CALL BUILDING : SAN FRANCISCO

SUGAR PINE GENUINE WHITE PINE

ALWAYS UNIFORM
and of the
RIGHT QUALITY

K-B

Core Binder and Facing Flour

Has gained wide recognition as a dependable quality binder and warrants investigation on the part of those foundries not already acquainted with its merits.—K-B should not be confused with other flour binders. *There's a difference!*

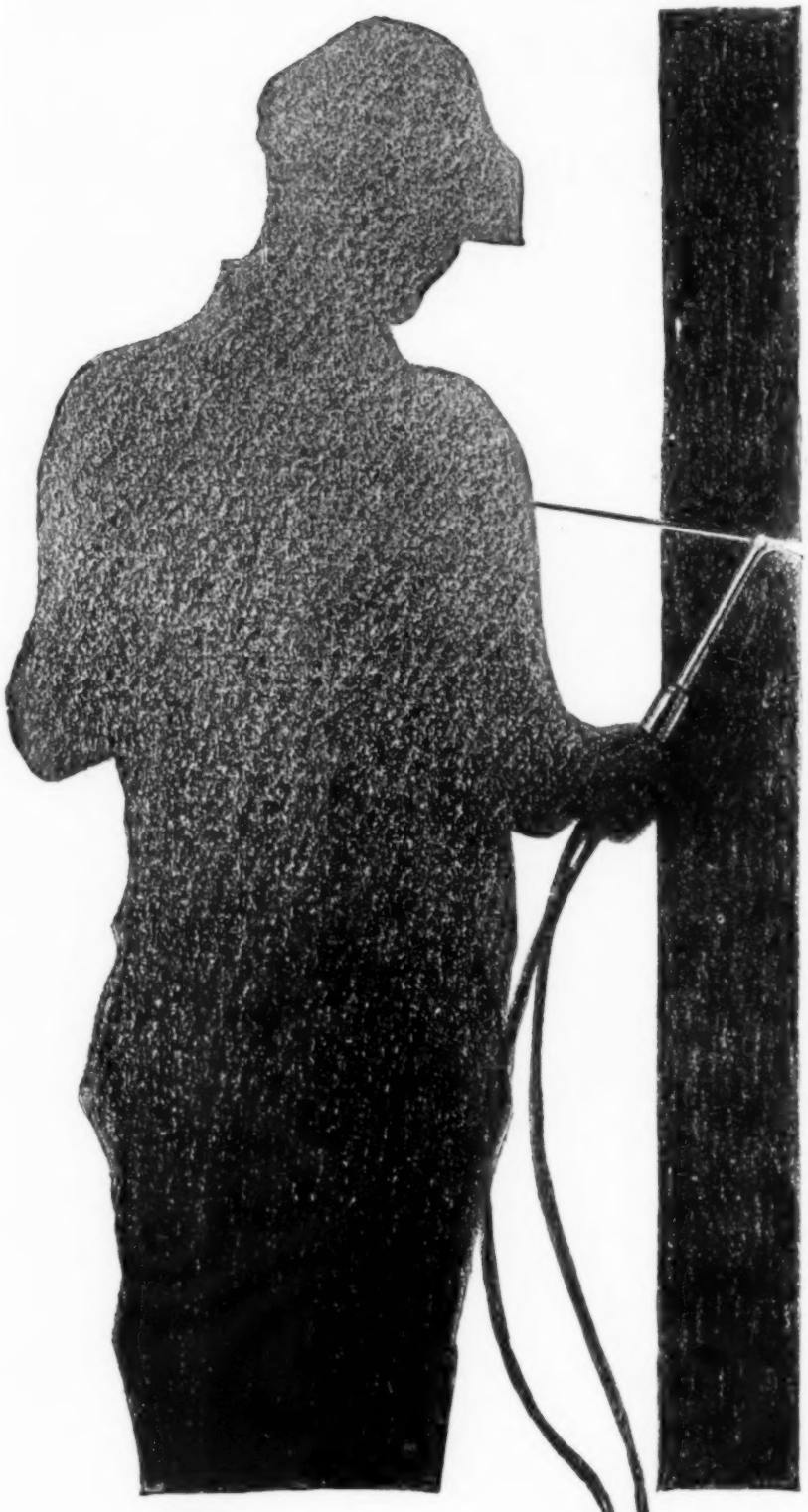
K TRADE MARK B

Knefler-Bates Manufacturing Co.
Indianapolis, Ind.

Distributing Warehouses located in all principal American cities.

Agents for Great Britain: Yorkshire Amalgamated Products, Ltd., 27 Waterdale, Doncaster, England.

Agents for Scandinavian countries: Otto Madsen, Copenhagen, Denmark.



21 years old *but still* Growing

Large volume usually indicates a good product. Certainly this is true of Prest-O-Lite dissolved acetylene which has been used in greater volume year after year for 21 years. Today you can obtain Prest-O-Lite for oxy-acetylene welding and cutting from 116 plants and warehouses.

The PREST-O-LITE COMPANY, Inc.
Oxy-Acetylene Division

General Offices: Carbide and Carbon Building
30 East 42d St., New York
In Canada: Prest-O-Lite Co. of Canada, Ltd., Toronto
31 Plants—85 Warehouses—22 District Sales Offices

Prest-O-Lite
DISSOLVED ACETYLENE

As Simple as Water Running Down Hill

Make Your own HARD PATTERN MATCHES They Last For Years

EVERY FOUNDRYMAN has made oil sand matches.

But oil sand matches last but a short time.

"MENCO" MATCHES last for many years.

That's why "MENCO" should be used by every foundryman.

"MENCO" hard matches are simple and easy to make—mixed in a pail, poured in a frame. And they will last for a long time.

YOU CANNOT AFFORD TO BE WITHOUT "MENCO".

SPECIAL PRICE now being made on 100 pound orders of MENCO. Write TODAY. Full instructions sent with first order. One Foundryman writes. "BEST thing we have ever used for Matches".

MENCO

Pattern Compound

The Menefee Foundry Co. Inc.

Sole Manufacturers

Fort Wayne **Indiana**

IT may be every 20 days, it may be every 50, but if you are not using a Dings "High Intensity" Magnetic Separator you are losing a day's charge of your furnaces over some stated period of time. It is going into the slag pile!

The Northwestern Malleable Iron Company of Milwaukee recover as 1½% of their daily charge—70 to 80 tons—with a Dings Magnetic Separator.

Their Dings saves them a loss of a day's charging every 50 days.

Figure the worth of a Dings to you.

DINGS MAGNETIC SEPARATOR COMPANY
675 Smith St., Milwaukee, Wis.
The largest exclusive builders of Magnetic Separators.
New York: 30 Church Street San Francisco: 419 Call Bldg

Dings High Intensity MAGNETIC SEPARATION

Recovering iron with a Dings P. B. Yates Machine Co., Beloit, Wis.

F12-15 Gray

SAND

Some "say it with flowers." Some with "gifts that last." Some send greeting cards and some send it by wire. But we say it with sand and service.

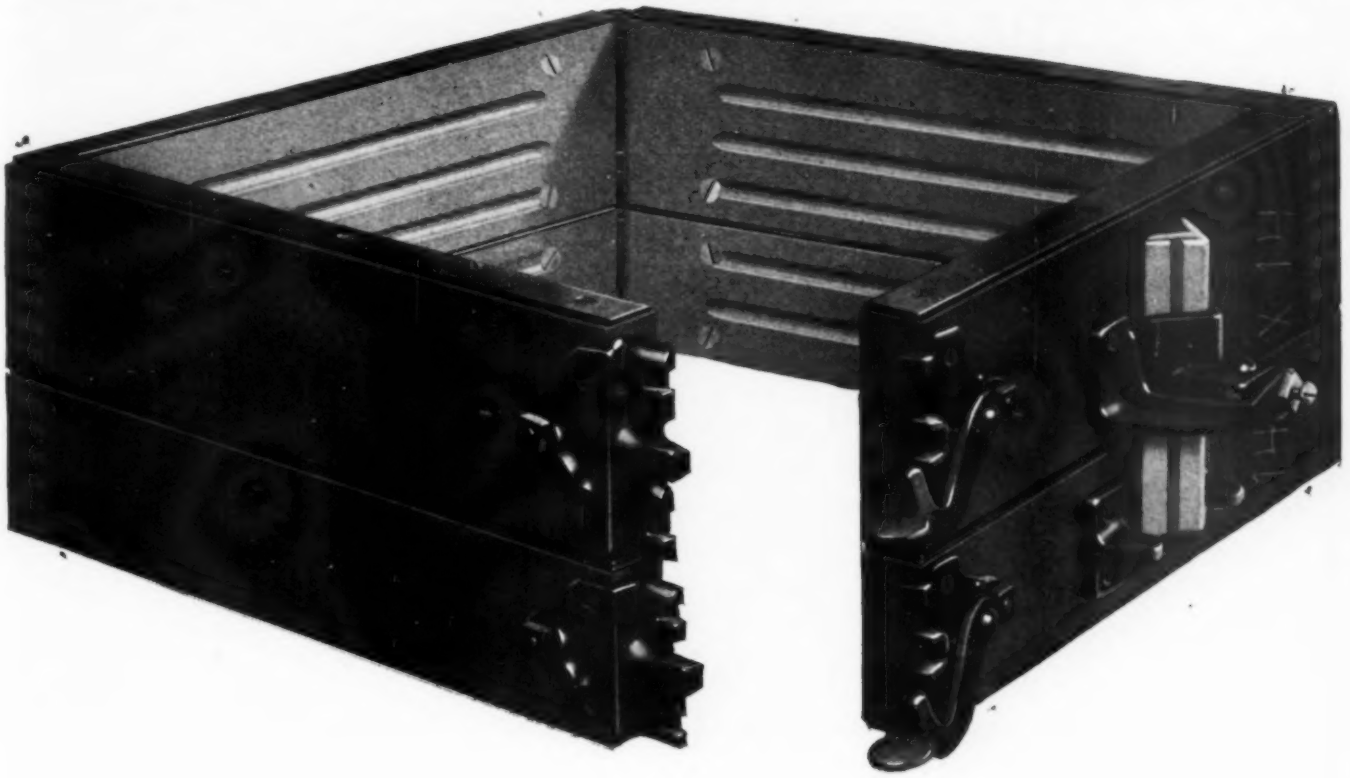
A Merry Christmas to all
and
A Happy New Year

STANDARD SILICA Company

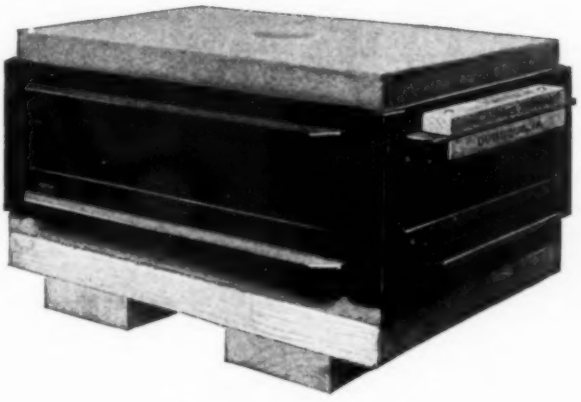
Plants at Ottawa, Illinois

General Offices: 39 South La Salle Street, Chicago

DAILY CAPACITY, 2000 TONS
YEAR 'ROUND DELIVERIES
LARGE STORAGE FACILITIES
PROMPT ATTENTION TO ALL ORDERS



Good Flasks Produce Profits



Adams Steel Jacket

Don't forget that a mold represents no value until it is poured. Safeguard your production with Adams Steel Jackets.

The kind of flasks used in a foundry determine to a large extent the quantity and quality of output.

The skilled molder deserves a good flask to work with, and he is hampered in his efforts unless accurate and properly fitted flasks are provided.

Then, too, the unskilled workman or apprentice needs a good flask if he is to produce castings without shifts and of uniform quality.

Adams Cherry Snap Flasks

are designed to meet the most stringent needs of modern foundry practice. Their accurate construction and convenience enable the molder to increase both quality and quantity of castings produced. Their durability makes them a profitable investment.

The Adams Company, Est. 1883 — 170 Foster Street, DUBUQUE, IOWA, U.S.A.

THE NIGHT BEFORE CHRISTMAS
In the Foundry

'Twas the night before Christmas when all through the shop
Not a creature was stirring, not even a cop,
When an old grain of sand awoke with a start
And blurted this out from the depths of his heart:
"I'm burdened with sorrow, I haven't done right:
My face is all blackened, I'm burned and a sight!
That smooth coat of clay I had at the pit
Is burned on a casting and now I'm not fit.
One day I'm too wet and the next day too dry;—
If there's a Santa Claus please hear my cry!
Our boss isn't a "Scrooge" and if he but knew,
He'd buy us sand grains a SIMPSON or two,
To coat us with bond and temper us right,
And improve the condition we're in tonight.
We then could make castings more perfect and clean,
And the boss sure would profit from a SIMPSON Machine."

The boss rolled and tossed as he lay in his bed,
As this dream of his foundry whirled through his head.
He knew competition next year would be keen;
To cut down sand and labor he also must scheme.
He thought of his dream and decided right quick
A Number Two SIMPSON MIXER would sure do the trick.
He thought of the waste sand that he could reclaim
By the use of clay bond that had sprung into fame.
So he wired in his order;—don't you think he did right?
A Merry Xmas to all, and to all a Good-night!

NATIONAL ENGINEERING SERVICE
FOR SAND HANDLING SYSTEMS

SIMPSON INTENSIVE SAND MIXERS
FOR PROPER SAND PREPARATION

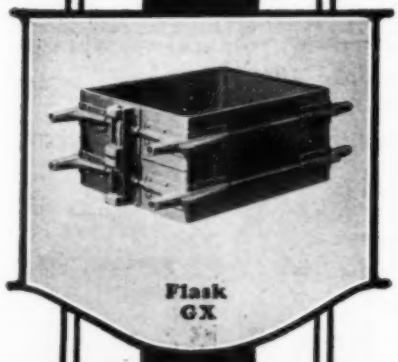
WRITE FOR DETAILED INFORMATION

NATIONAL ENGINEERING COMPANY
MACHINERY HALL BUILDING 549 W. WASHINGTON BLVD.
CHICAGO, ILL., U. S. A.

Sterling

Foundry Specialties

Wheelbarrow No. 7



Flask GX

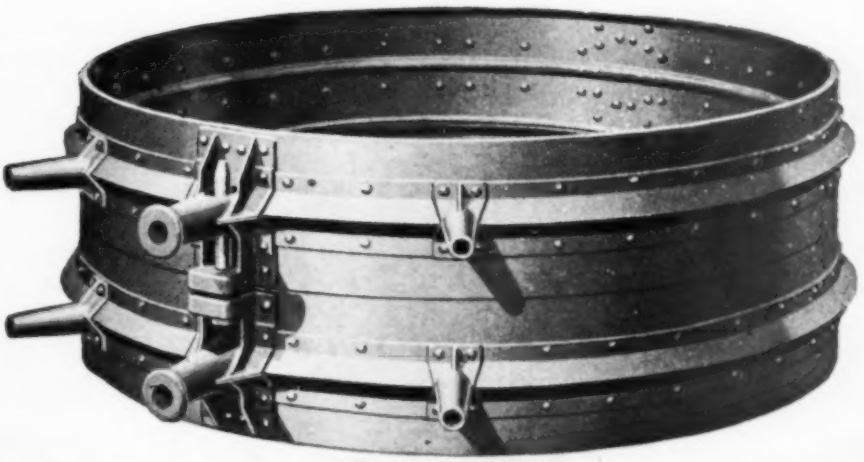
Truck No. 44

—a quality line of *Rolled Steel Flasks—Barrows—Trucks—Shop Boxes—Skim Gates and Wedges—Slag Buggies,* etc., especially designed and built to increase foundry production and to lower labor cost.

—more than 3,000 foundries use Sterling products — proof enough that they are money makers.

—sold by an organization of sales engineers, trained in the foundry and industrial fields, who know the proper application of each Sterling product. One of these men is near you—ask him to call—you incur no obligation.

We will gladly send a complete catalog—write for a copy.



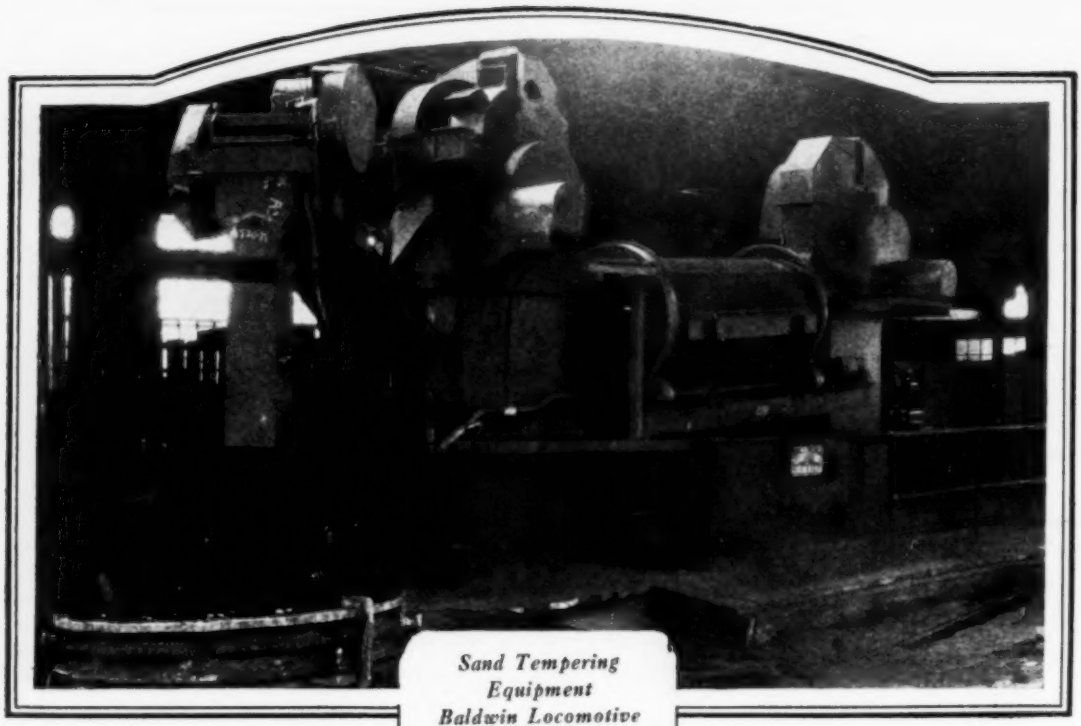
Flask Style BBLT

STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee Wisconsin

MANUFACTURED FOR THE EUROPEAN MARKETS BY:—
STERLING FOUNDRY SPECIALTIES LTD STERLING WORKS, BEDFORD, ENGLAND



Sand Tempering Equipment Baldwin Locomotive Works

Would You Let Every Molder Melt His Own Metal?

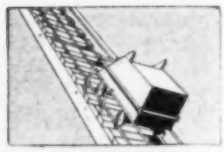
If every molder melted his own metal you would expect a high percentage of defectives—losses that would eat up all your profits. Melting has long been a specialist's job—the best temperature for each class of work is accurately determined—the process is carefully controlled.

Next to proper melting, sand probably plays the biggest part in the production of sound castings. Yet the conditioning of sand is usually left to the individual molder. As a result there is often a wide variation in the work produced in the same foundry.

Bartlett-Snow Sand Handling and Conditioning Equipment provides a sure way of obtaining a uniform supply of properly tempered molding sand. It frees you from the fancies of the individual molder, helps to reduce losses and to make foundry operation more profitable.

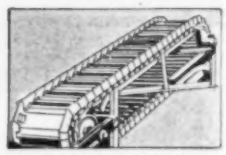
Bulletin No. 56 describes the machine that cuts, blends and aerates the sand and gives it new life. It tells how sand can be controlled so that it always comes the same—how it can be tempered to exactly suit the class of work on the floor. A copy of this valuable book gladly sent on request.

THE C. O. BARTLETT & SNOW CO.
6201 Harvard Ave. Cleveland, Ohio

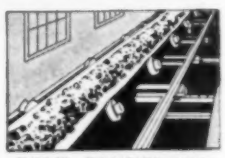


SKIP HOISTS

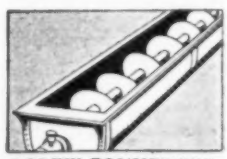
BUCKET ELEVATORS



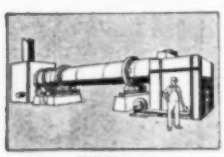
APRON CONVEYORS



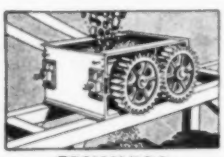
BELT CONVEYORS



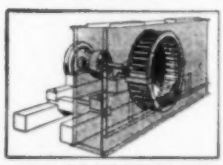
SCREW CONVEYORS



DRYERS



CRUSHERS

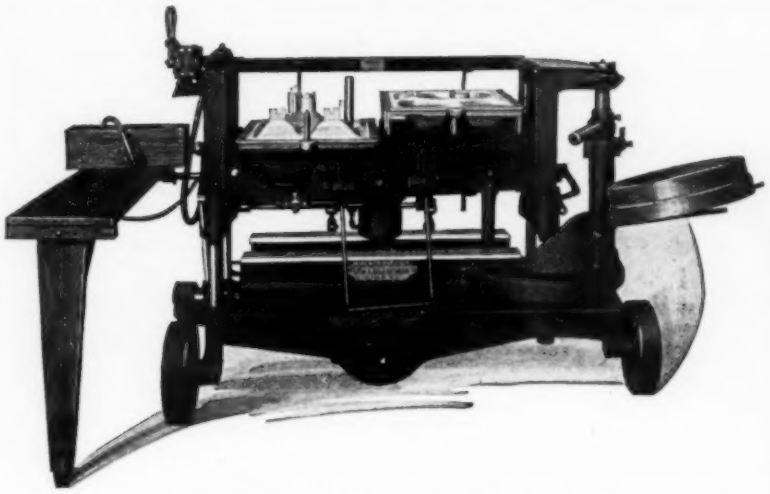


SAND CONDITIONERS

Bartlett - Snow

SAND HANDLING EQUIPMENT

ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT



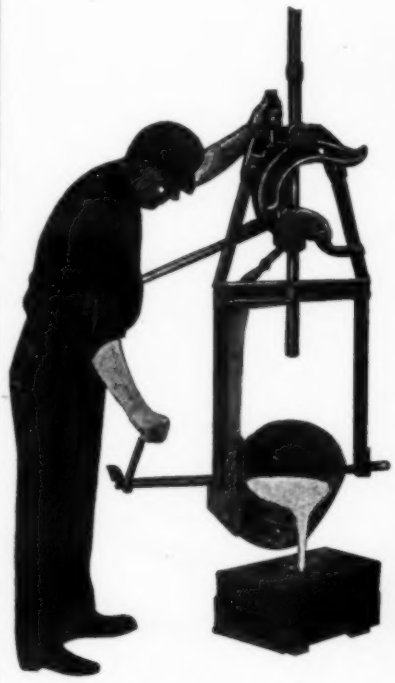
No. 110 and 220 Jolt Moderns

Jolt Rollover Squeeze Pattern Draw. Many new improvements. Ask for bulletin No. 31-A

No. 610 Duplex Jolt Stripper.
Perfect draw.

This is the most perfectly protected Jolt Stripper made. No sand can filter in. Ask for bulletin No. 31-E.

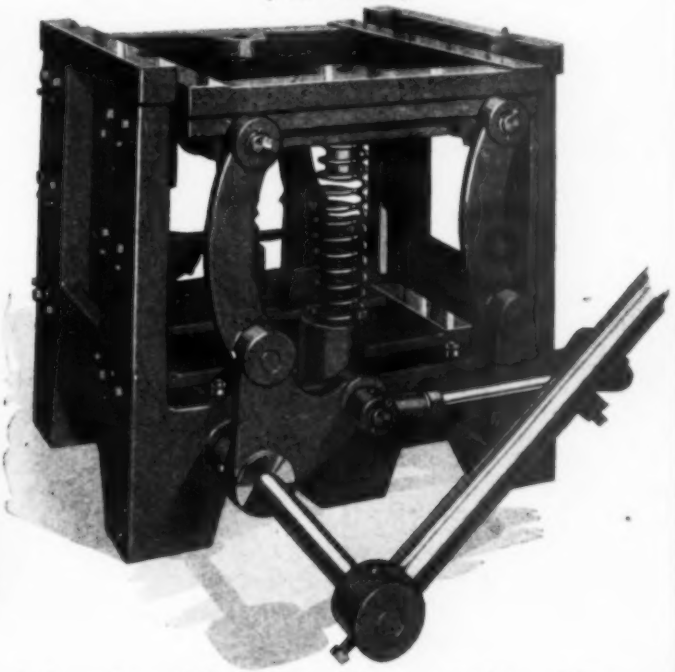
Stripping Plate Machines
(all sizes)



No. 1 Brillion Pouring Device
CRANES TOO
New Low Prices

Cherry Flasks
MILLED PINS AND EARS

Steel Jackets
No. 10 Gauge
WELL BRACED



Independent Adjustment of Pattern Table. Movement Permanent and above center of stripping shaft. Bushed throughout.

Arcade Manufacturing Company Freeport, Illinois U. S. A.

Cut Expenses and Increase Profits

Use The Speedy Reliable Universal Riddle

Convenient portable stand for Riddle. Price $25.00.

Easily handled by one man: weight 60 lbs. Riddle 21 inch: mesh according to requirements. May be used on any hook or trolley. Two wire Riddles provided with safety ground wire.
No additional cost for 3 phase or direct current motors. Please give the correct current when ordering.

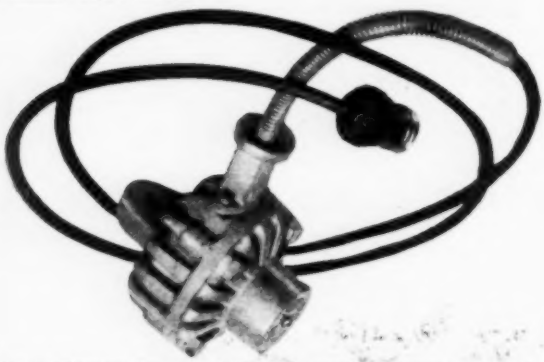
Price $150.00 f.o.b. Chicago

For the Most Reliable Service at the Lowest Operating Cost

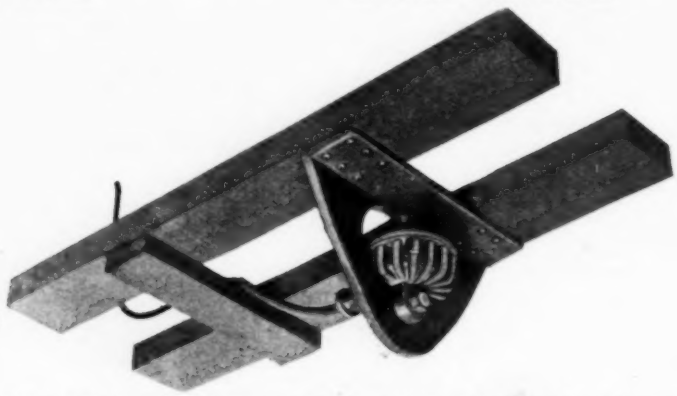
USE the RED ELECTRIC VIBRATOR

Manufactured in four sizes, consecutively doubled in capacity.
No. 1 Vibrator for light match plates.....**$10.00**
No. 2 Vibrator for medium match plates.....**$13.00**
No. 5 Vibrator for heavy match plates, tub and bench work.....**$17.00**
No. 9 Vibrator for machine and heavier work, **$21.00** without cable: **$24.00** with cable.
Vibrators provided with third safety ground wire in accordance with the U. S. Government Code, $1.00 extra. No extra charge for No. 9 Vibrator. Be sure to give correct voltage and cycle when ordering.

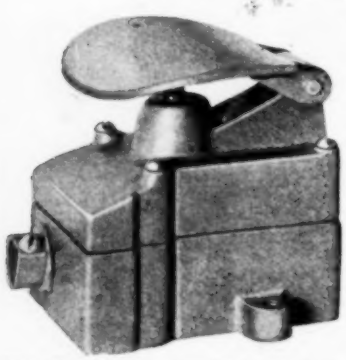
UNIVERSAL SAND RIDDLE



No. 5 Vibrator (improved No. 4) is used for bench, tub and heavy match plate work. It is double the capacity of the No. 2 Vibrator. Price $17.00.



No. 5 and No. 9 Aluminum Brackets for fastening No. 5 and No. 9 Vibrators to skids for tub use or to ordinary bench. Very effective for match plate and other work. Price of Bracket including screws and bolt for fastening, $5.50.



Knee Switch for operating vibrators.
Single pole Switch..... $3.00
Double pole Switch..... $3.50

No. 9 Vibrator (improved No. 8) is double the capacity of the No. 5 and may be used for machine work or where heavier vibration is required.

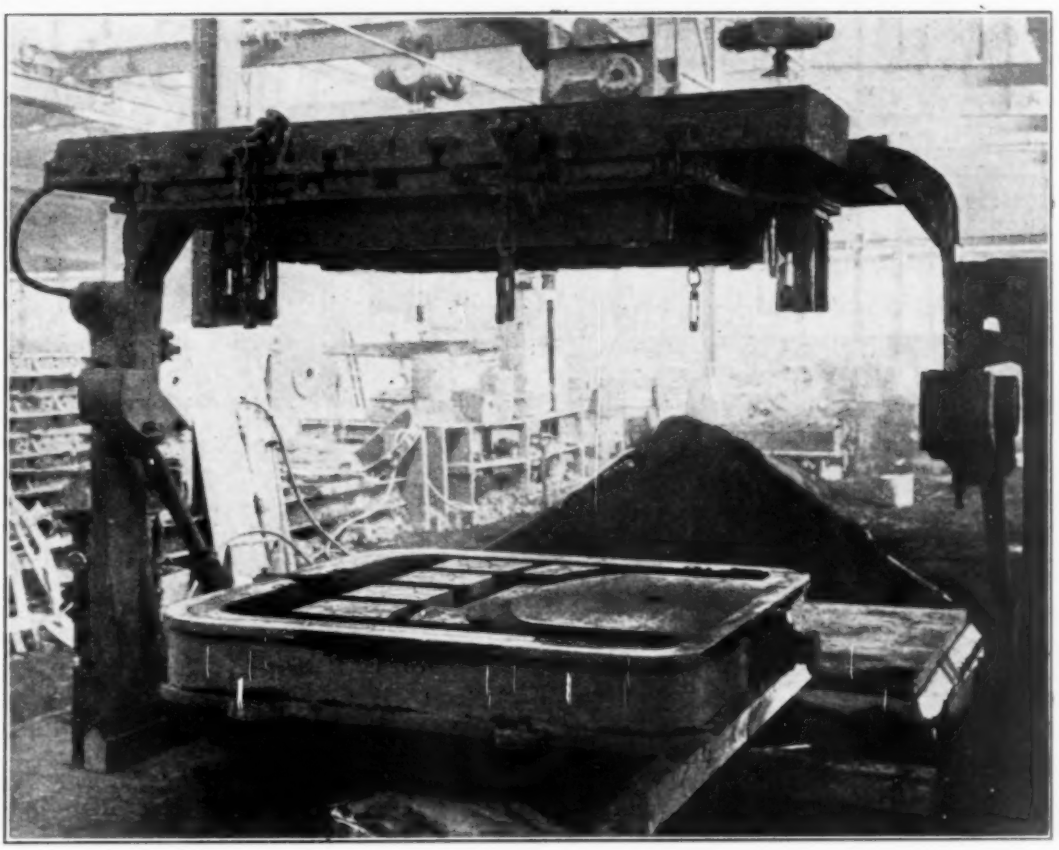
Price $21.00 without cable: $24.00 with cable.

Order from your supply house today

FOUNDRY SUPPLIES MFG. CO.

2221 Orchard St., Chicago, Ill., U. S. A.

If It's A Herman It's Worth Using. It Made Its Way by the Way it's Made



Boiler Section Work made on Herman Machines

Herman Jar Independent Rollover and Pattern Drawing Machines put *speed and efficiency* into such work as boiler sections, engine beds, cast iron columns, machine tool frames, cylinders, and all other work of medium or larger nature. *Ask users—they'll convince you.*

May we have your inquiry? Our Service Department will gladly advise you on your molding machine requirements for such work. This service is free of cost or obligation.

Herman Pneumatic Machine Company
GENERAL OFFICES: Union Bank Building, PITTSBURGH, PA.
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.
Foreign Works: Pneumatic Engineering Appliances Co., Ltd., Palace Chambers, Westminster, London, S. W., Eng.

What Happens in the Sandblast

A SCIENTIFIC study of sandblasting, extending over a period of several months, was made by a corps of engineers of the Stoney Foundry Engineering & Equipment Co., of Cleveland.

Flint Shot, five other mineral abrasives, steel shot and angular steel grits were tested, on many different metal surfaces, at pressures ranging from 30 to 80 lbs., and the surfaces treated were photographed.

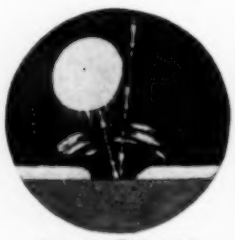
Air-Slippage Measured

In one of these tests they measured, with a Flow Meter, the difference between the flow of **free** air through the nozzle, and the air consumed when the various abrasives were admitted to the line. With steel shot, they recorded only 6.6% less flow with the abrasive than without it; while Flint Shot consumed 31.3% less air than before it was admitted. The inference is, of course, that a given column of air under pressure can pick up and carry only about 1/5 as many steel shot as the lighter Flint Shot—the balance of the air slipping past without doing work.

Why FLINT SHOT Works Faster

The smaller number of projectiles accounts for the frequently-observed fact that it takes longer to clean a given surface with metal than with Flint Shot—and that more air power is required at identical pressures by the metal abrasives.

Another reason why production is slower with steel shot than with Flint Shot is that the heavy metal



Elastic Rebound of FLINT SHOT Another Reason

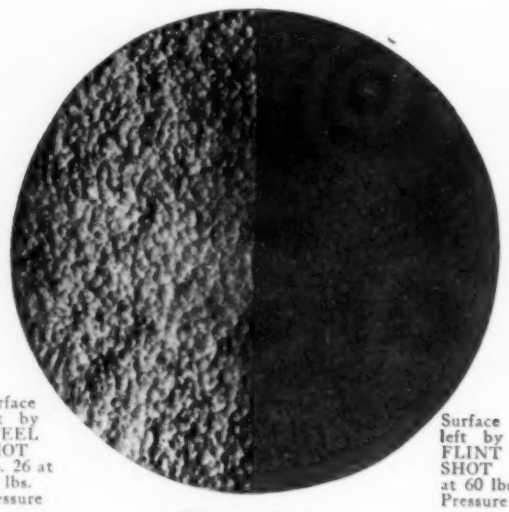
Heavy Impact Shot of Steel

"bullets" tend to pierce **through** the scale or sand and into the metal, while each flint projectile strikes with an elastic impact-and-rebound that "bounces" the scale loose over a large area, instead of punching a tiny hole **through** it. This is illustrated in the small cut above.

UNITED STATES SILICA Co.
122 South Michigan Ave. Chicago

The difference in microphotographs confirmed this explanation—the Flint-Shotted surface being clean and smooth, while the metal-blasted is deeply pitted.

Send for a copy of "Sandblasting Up-to-Date" containing the full text of the Stoney Engineering Report on these noteworthy tests.



Surface left by STEEL SHOT No. 26 at 60 lbs. Pressure

Surface left by FLINT SHOT at 60 lbs. Pressure

Micrograph of Malleable Casting

Speedy!

Model "H"
Jolt Squeeze
Machine

Easy to Operate!

This is *the* Machine for the General Jobbing Foundry!

Users say its high production of small and medium sized castings of brass, malleable or grey iron—per day—makes it a very profitable investment.

Match plates or split patterns can be used.

Write us for full particulars on this and other Berkshire models.

The BERKSHIRE
for Quality and Production

The Berkshire Mfg. Co.

1011 Power Ave., Cleveland, Ohio

Michigan representative: Chas. J. Skeffington,
460 Lakewood Blvd., Detroit, Michigan.

Foreign representative: John MacDonald & Co.,
34 King Street, Pollokshaws, Glasglow, Scotland.

Protects Capillarity— Prevents Contamination

An Improved Container for the Improved Abrasive

A KEG that delivers abrasive grain to you in the same perfect condition as when packed and that allows you to maintain this condition in your plant right down to the last ounce—this is the latest contribution of Norton research engineers—and an exclusive Norton feature.

To get at the contents the whole head of the keg does not have to be knocked out exposing the abrasive to moisture and dirt. A small and easily replaceable bung allows you to remove the desired quantity of grain and then again seal the keg. The capillarity of the abrasive is maintained down to the last ounce.

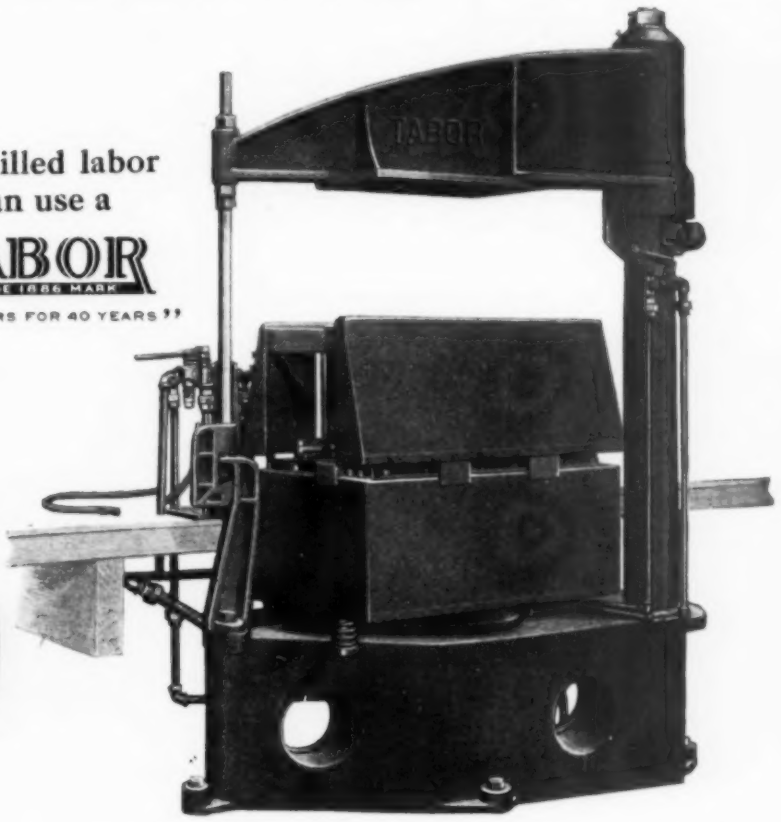
NORTON COMPANY, WORCESTER, MASS.
New York Chicago Detroit Philadelphia Pittsburgh Hartford
Norton Company of Canada, Limited Hamilton, Ontario

NORTON
POLISHING ABRASIVES

Jar Squeeze Strippers

Longer Life - Greater Production - Minimum Air Consumption - Stooling Possible

"Unskilled labor can use a TABOR TRADE 1886 MARK PIONEERS FOR 40 YEARS"



This Portable machine is furnished in the Plain Jar type in two sizes,—With 10" squeezing cylinder for plates from 10 to 14" wide. With 13" squeezing cylinder for plates from 12 to 18" wide—and is designed to permit being adjusted readily to take plates of various widths within the capacities shown.

This larger stationary machine is of the shockless jar type, and can be furnished with 20", 26", 30", or 38" squeezing cylinders, as required.

ALL Tabor *Jar-Squeeze-Strip machines* are of the flask lifting type, utilizing the patent Tabor central draw, which makes possible the following Tabor features of desirable performance: Accurate draw through the entire life of the machine; Speedier production due to the shorter travel required to deliver the finished mold; Greater air economy due to the larger squeezing cylinder being used only for the short squeezing stroke, the longer draw stroke being accomplished by a cylinder only large enough to lift the weight of the mold; The use of stools which prevent drop-outs of hanging sand. All machines are open-ended, permitting the use of flasks of varying length. If you have work which requires squeezing in addition to jarring and stripping, write us full description for our recommendation of a suitable machine If your work does not require all of these operations, tell us what you have to make—TABOR HAS THE PROPER MACHINE FOR THE JOB.

THE TABOR MANUFACTURING COMPANY

6225 TACONY STREET : PHILADELPHIA : PENNA.

"American" Steel Abrasives *for Blast-Cleaning*

Just a year ago the first shipment of "American" steel abrasives left our factory.

The phenomenal increase, each month, in volume shipped, justified the months of investigation, and experiments undergone before we started to manufacture.

This success is based on three factors:

Quality We experimented until we had the hardest, sharpest, and longest wearing abrasives on the market. By our exclusive method of manufacture our abrasives are clean, and run uniform in sizes. A magnifying glass shows this uniformity, and the clean brilliancy of our cut Eversharp Steel Grit.

Sizes We numbered our sizes in accordance with already established standards, viz: Roebling's and W & M's standard steel wire gauge numbers from 10 to 30 are the sizes and numbers of American Standardized Steel Shot; and the standard wire screen mesh numbers are the sizes and numbers of American Eversharp Steel Grit.

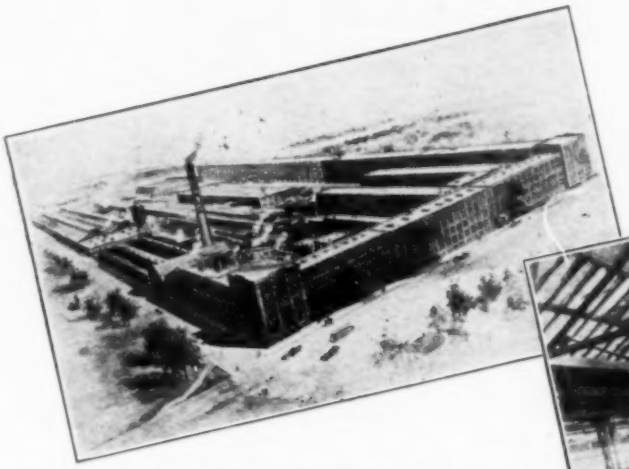
Service Buyers of American Abrasives are getting a personal, interested service. Shipments are made promptly and requests for certain delivery dates are followed to the very letter. We have the facilities for giving the high-type service making shipments from warehouse stock.

We guarantee American Eversharp Steel Grit to contain less than ¼ of 1% by weight of round shot.

The American Steel Abrasives Company

604 Sherman St., Galion, Ohio

Moline Molding Machines



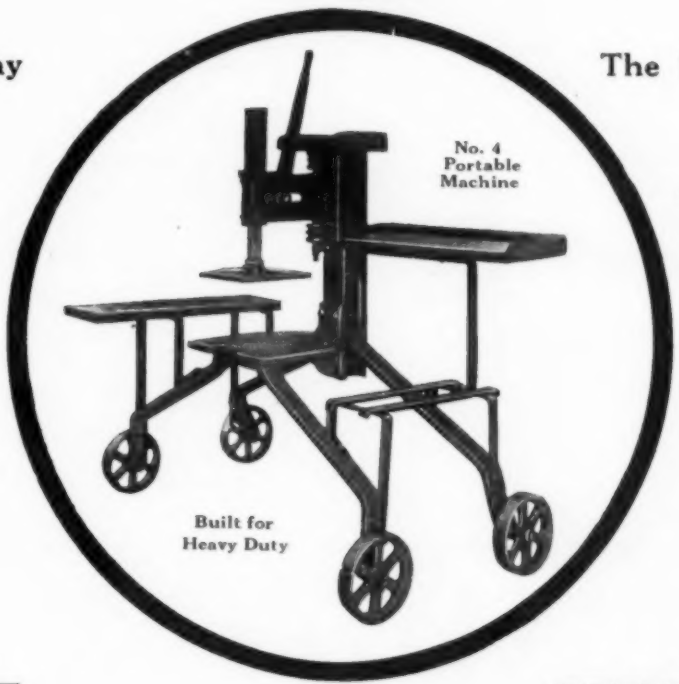
The Yale & Towne Manufacturing Co.
Stamford, Conn.
(largest makers of locks in the world)

Have one of the largest and best equipped foundries in the country and are using an increasingly large battery of

Moline Molding Machines

To reduce costs and increase production.

Moline Squeezers Pay for Themselves Soon After Installation.



The Machine Illustrated is one of four types which we manufacture.

NO. 1 STATIONARY

NO. 2 PORTABLE
(Side of pile type)

NO. 3 PORTABLE
(Straddle Type)

NO. 4 PORTABLE
(Heavy duty - Straddle type)

SIMPLE EFFICIENT RELIABLE

Write today for complete descriptive catalogue.

"All The Working Parts Are Above the Table and Flask"

Think What This Means!

Moline Iron Works
Moline, Illinois
U. S. A.

For heating hard-to-heat places—this winter

STRIP HEATERS
for heating solids; metals, compounds, etc. Over 80 standard lengths and ratings. Quick shipments from stock!

RING UNITS
for clamping to bottom of small tanks, boilers, vats and kettles. Sizes 3" to 11" diameter.

IMMERSION HEATERS
for heating fluids; water, oils, solutions, etc. Most economical method for heating tanks, etc., where direct heat energy is desirable. Over 30 catalogued sizes. Easily installed!

CHROMALOX

ELECTRIC HEATERS
for heating hard-to-heat places. 45 sizes and ratings. Three types: Horizontal, Vertical and Portable. 1000, 1500, 2000 and 3000 watts. 110, 220, 250 volts. Completely assembled. Always ready. Built to last. No fire hazard. Write for Bulletin C-108—just use the coupon!

The Railway Utility Company of Chicago is sole distributor of Chromalox Strip Heaters for use in heating railroad and street cars in the United States and Canada. Sole Canadian Licensees: The Canadian Chromalox Co., Ltd., 251 Queen St., East, Toronto, Ontario, Canada

CHROMALOX HEATING UNITS

MANUFACTURED EXCLUSIVELY BY

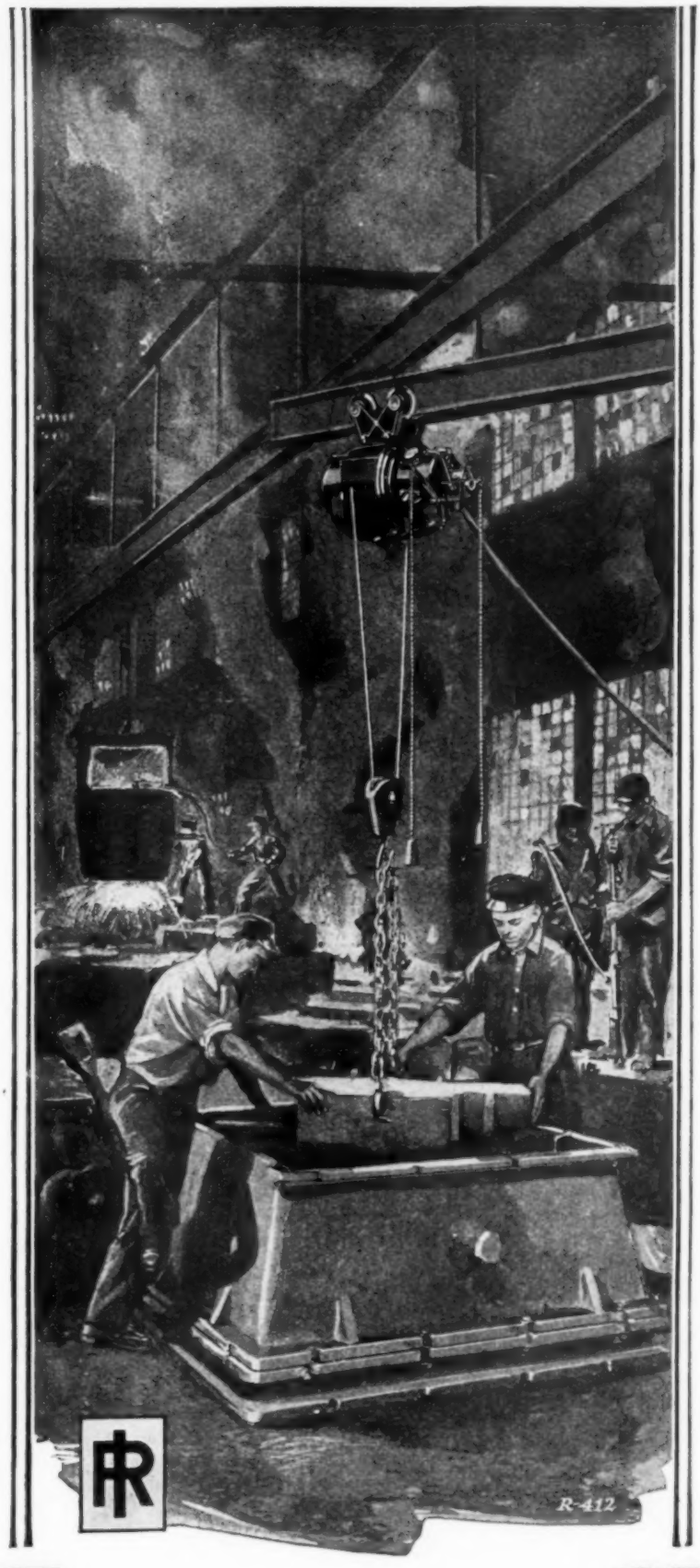
EDWIN L. WIEGAND CO., 422 FIRST AVENUE, PITTSBURGH, PA.

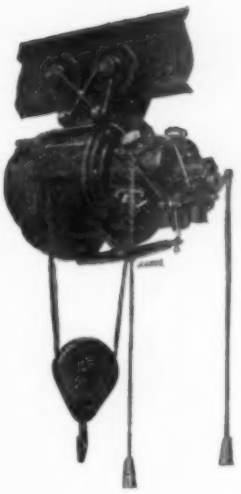
Mail with Your Letterhead Please send Bulletin C-106 telling about Chromalox Strip, Space, Ring and Immersion Units and Bulletin C-108 about Chromalox Electric Heaters—with prices. F11

We need Electric Heat for.....

.....

Signed..... Title.....





I-R Air Motor Hoists

The most dependable hoists for production work

Ingersoll-Rand air motor hoists have many special features which make them reliable and economical in operation.

They require very little attention except occasional lubrication. All the motor parts are automatically lubricated when oil is added.

They have accurate control lifting and placing loads exactly. An automatic brake positively holds the load under all conditions.

They are not damaged by overloading—remove the overload and they start as good as ever. Dust, dirt, and fumes do not cause trouble.

The hoists are made in six sizes, with capacities ranging from 500 to 10,000 lbs. Ask for complete information.

INGERSOLL-RAND COMPANY
11 Broadway New York City

Offices in principal cities the world over.
For Canada Refer-Canadian Ingersoll-Rand Co., Limited
260 St. James Street, Montreal, Quebec.

Ingersoll-Rand

The Titanium Alloy Manufacturing Co.

Niagara Falls, N. Y., U.S.A.

BRANCH OFFICES:
94 FULTON ST., NEW YORK
OLIVER BUILDING, PITTSBURGH
6007 EUCLID AVE., CLEVELAND

FERRO CARBON TITANIUM
REG. U.S. PAT. OFFICE TRADE MARK
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AGENTS FOR
GREAT BRITAIN AND EUROPE
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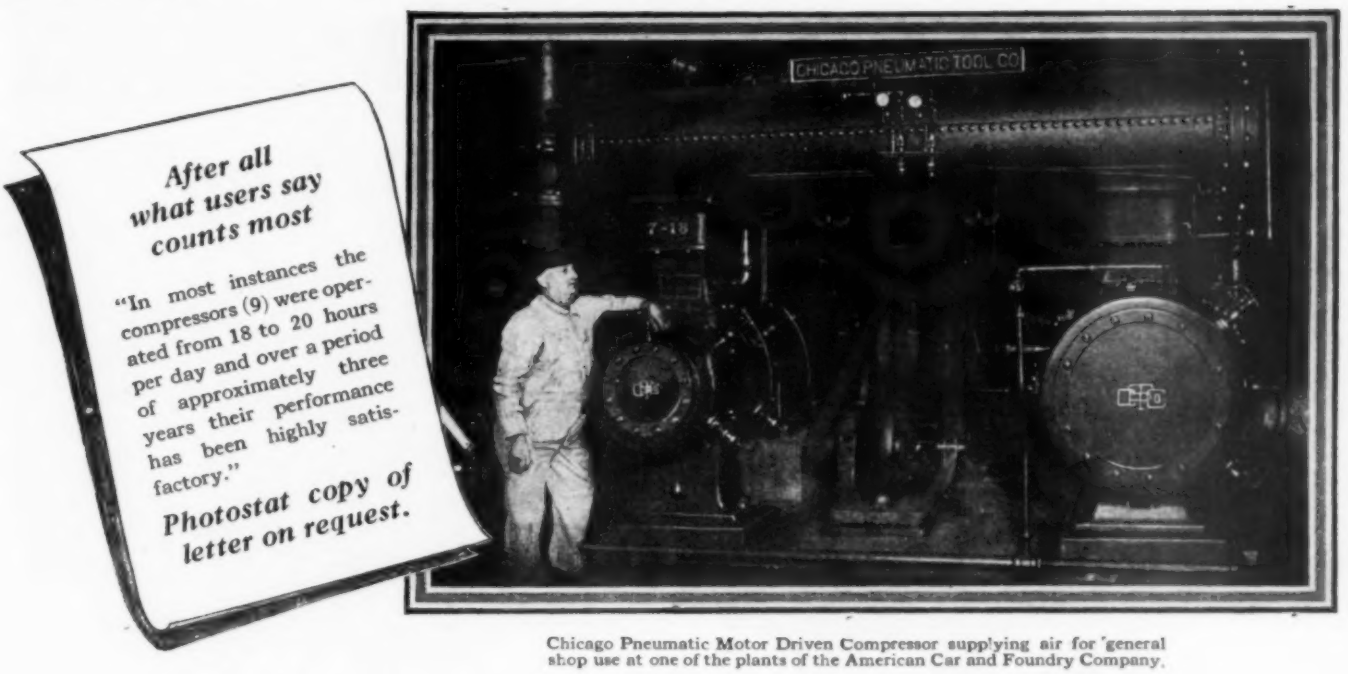
SHEFFIELD, ENG.


After all what users say counts most
"In most instances the compressors (9) were operated from 18 to 20 hours per day and over a period of approximately three years their performance has been highly satisfactory."
Photostat copy of letter on request.
CHICAGO PNEUMATIC TOOL CO

Chicago Pneumatic Motor Driven Compressor supplying air for general shop use at one of the plants of the American Car and Foundry Company.

For Sustained Compressor Efficiency

COMPRESSOR efficiency and dependability play an important part in production economy when compressed air is used as a source of power.

Chicago Pneumatic Compressors, with such features as Simplate Valves, self-lubrication and automatic regulation, assure the greatest possible overall efficiency, economy and reliability.

Simplate Valves, an exclusive feature of all CP Compressors, permit a straight lift without twisting or bending. This affords maximum valve area which results in high volumetric efficiency and low power consumption per unit of air actually delivered.

Chicago Pneumatic Stationary and Portable Compressors are supplied in steam, oil, belt and direct motor driven types to meet all requirements. Write for Bulletins.

Chicago Pneumatic Tool Company

6 East 44th Street, NEW YORK, N. Y.

*Sales and *Service Branches all over the World*

*Birmingham	*Cleveland	Houston	*New York	*San Francisco	*Berlin	Calcutta	Helsingfors	*London	Moncton	*Paris	*Sao Paulo	Timmins
*Boston	Dallas	Knoxville	*Philadelphia	*Seattle	Bogota	Copenhagen	Honolulu	Madrid	*Montevideo	Ponce	Seoul	Tokyo
Buffalo	Denver	*Los Angeles	*Pittsburgh	*St. Louis	*Bombay	Dairen	*Johannesburg	Manila	*Montreal	Rio de Janeiro	Stockholm	*Toronto
*Chicago	*Detroit	*Minneapolis	Richmond	Tulsa	*Brussels	*Durban	Kobe	*Mexico City	Osaka	*Rotterdam	Sydney	*Vancouver
*Cincinnati	El Paso	*New Orleans	Salt Lake City	Athens	*Buenos Aires	*Havana	Lima	*Milan	Oslo	Santiago	Tampico	*Winnipeg

Canadian Pneumatic Tool Company, Ltd., Montreal, manufacturers of Chicago Pneumatic products in Canada
Consolidated Pneumatic Tool Company, Ltd., London, manufacturers of Chicago Pneumatic products in England

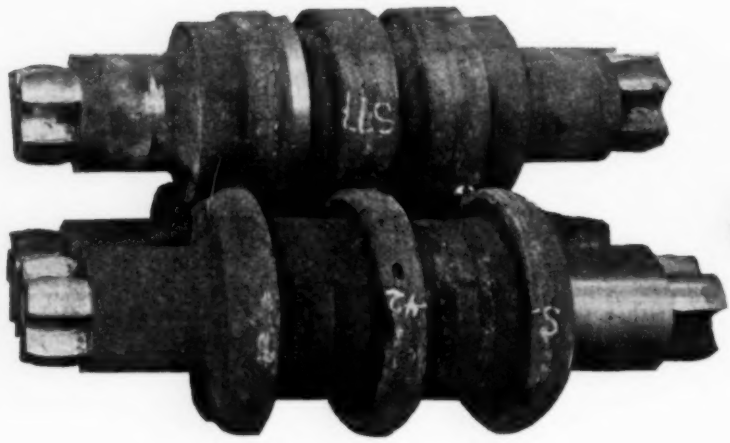
C-207

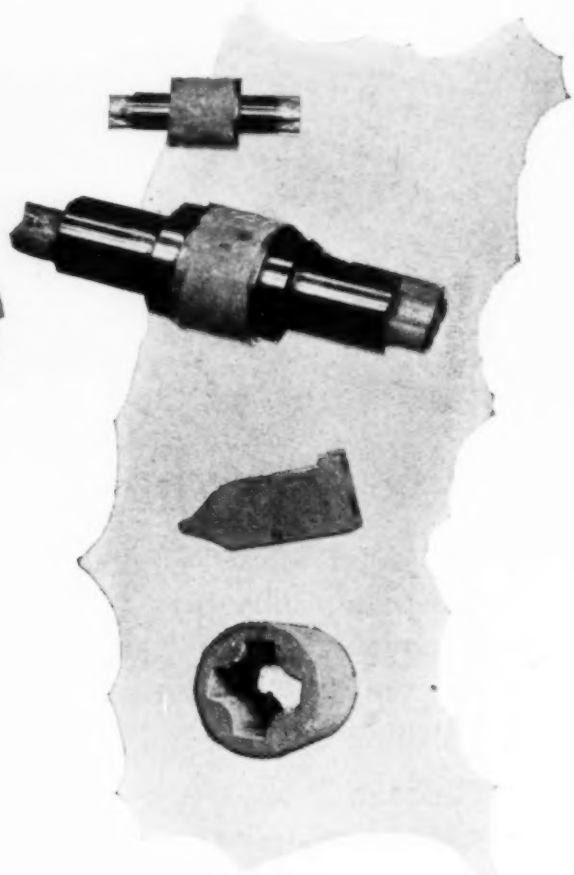
CHICAGO PNEUMATIC AIR COMPRESSORS · BOYER PNEUMATIC HAMMERS · ROCK AND COAL DRILLS · CONDENSERS
LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS · GIANT OIL AND GAS ENGINES · VACUUM PUMPS · OIL BURNERS
PAINT SPRAYERS · TOOL BALANCERS PNEUMATIC HOISTS · SAND BLASTERS

CHICAGO PNEUMATIC

Depend upon *that Name*

A few ways Mayari is serving the Steel Industry





Almost all of the large manufacturers of steel mill rolls use Mayari in casting their special alloy iron rolls. The use of Mayari in the iron mixture of the rolls not only gives them additional strength and durability over that obtained with other materials, but produces rolls that are sound and do not readily fire-crack.

Other items used in steel mills such as delivery and entry guides, carriages and coupling boxes can be made to give longer life with Mayari in the iron mixture. Mayari castings are clean, free of blow-holes and machine easily.

A Bethlehem foundry expert will gladly consult with you on the use of Mayari.

Mayari Pig Iron

for Making Better Castings

Mayari Pig Iron Booklet sent on request

BETHLEHEM STEEL COMPANY—*General Offices:* BETHLEHEM, PA.

District Offices:

New York, Cunard Bldg.
Boston, Atlantic Nat. Bank Bldg.
Philadelphia, Widener Bldg.
Baltimore, Continental Bldg.
Washington, Wilkins Bldg.
Atlanta, Healey Bldg.
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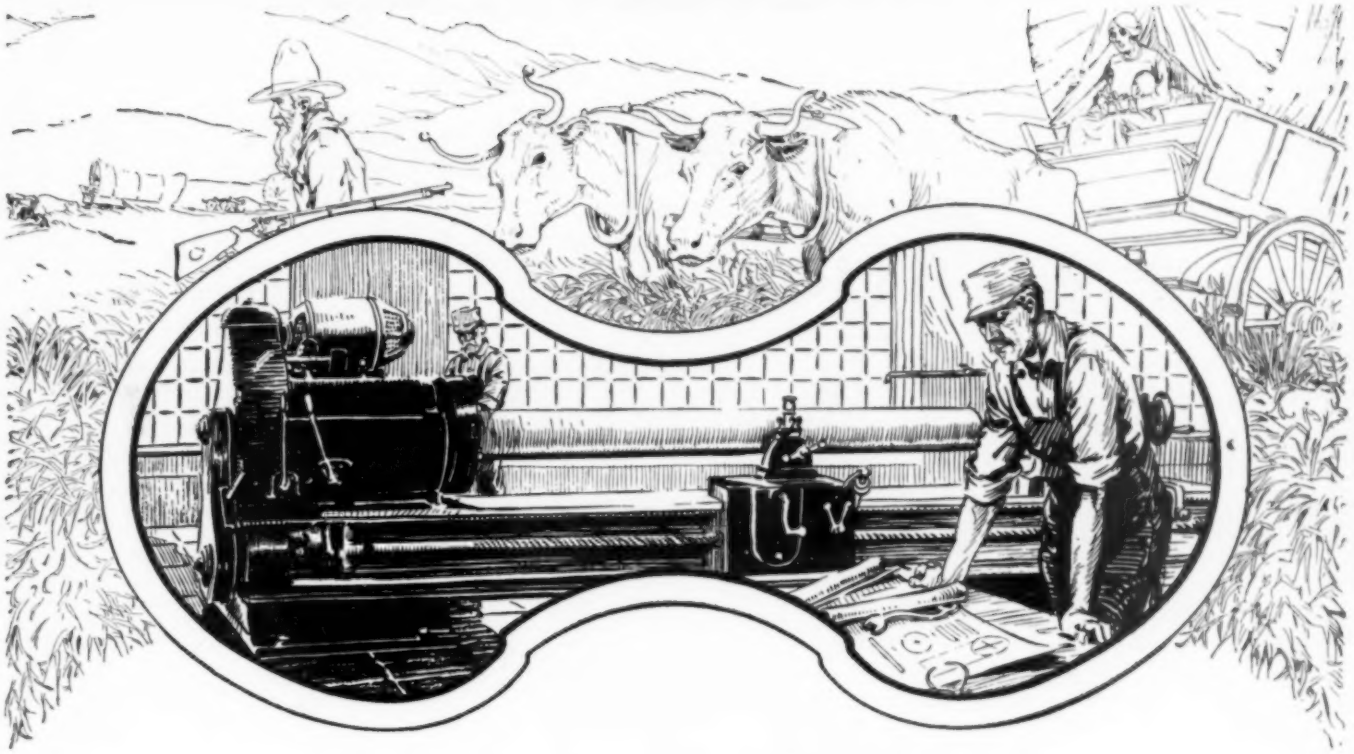
Buffalo, Marine Trust Bldg.
Cleveland, Union Trust Bldg.
Cincinnati, Union Trust Bldg.
Detroit, Penobscot Bldg.
Chicago, Peoples Gas Bldg.
St. Louis, Arcade Bldg.
Los Angeles, Pacific Finance Bldg.
San Francisco, Matson Bldg.
Seattle, L. C. Smith Bldg.
Portland, Northwestern Bank Bldg.

BETHLEHEM STEEL EXPORT CORPORATION, 25 BROADWAY, NEW YORK CITY, *Sole Exporter of our Commercial Products*

BETHLEHEM



PIONEERS

JUST a brief decade after the "forty-niners" started their trek across the plains for California gold, the Roots brothers devised the first Roots unit.

In its true sense, they were *pioneers*, and their "prospecting" in the field of manufacture produced the forerunner of a line of equipment that raised the standards of efficiency in a dozen industries.

Valuable as the enunciation of the principle may be, no less valuable is the part that is played by those who make it a reality of iron and steel.

It is to the cooperation of faithful progressive workmen that we owe much of the success of the Roots principle as represented by Roots equipment.

Men, many of whom are old, but not "old-fogy" — careful, but not slow — modern and alive to today's needs, yet tempered by that all too uncommon quality "conservatism."

It is to these men "Master Craftsmen," that we owe much. Their knowledge of Roots equipment is intimate; their acquaintance with the fields which Roots equipment serves is the result of experience and study; their honesty concerns itself with dimensions and mechanical tolerances.

They have played a big part in the popularity of Roots equipment.

Nearly one-fourth of our personnel has been in our employ for more than 25 years and 75% have more than ten years on the record.

You can depend on Roots' workmen to maintain craftsmanship quality in *your* Roots units.

The P. H. & F. M. ROOTS CO.

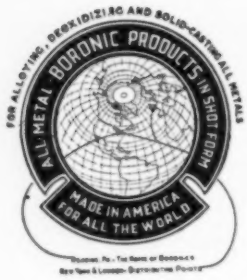
CHICAGO
Peoples Gas Building

CONNERSVILLE, INDIANA

NEW YORK
120 Liberty Street

You Can Easily Produce Metal *of* Quality and Stability

In the days when Brass and Bronze, specked with honeycomb and gas holes, proved a commercial failure, it was a self gone conclusion that the mold was not properly vented or from some such trifling cause the casting came to be a loss. Today we rather look upon the oxides held in suspense in the metal as mischief makers. Clear out the oxides and other deteriorated particles of metal with the use of Boronic Copper Alloys (in shot form) and you at once transform the metal in the crucible or furnace into a free flowing fluid which passes very readily into every nook-and-crook of the mold bringing as a result a finely finished surface to the casting and in addition a metal that is homogeneous, structurally sound, strong and easily machined; a metal which has all the desirable qualities of high grade general purpose brass or bronze in its original goodness. In fact many tests made of tensile strength carry unusual indications of soundness and quality as compared with untreaded metals.


FOR ALLOYING, DEOXIDIZING AND SOLID-CASTING ALL METALS
ALL METAL BORONIC PRODUCTS IN SHOT FORM
MADE IN AMERICA FOR ALL THE WORLD

These tests are illuminating to the average foundryman and are liberally illustrated in the

"STORY OF BORONICS"

a copy of which we shall be pleased to send any reader of this paper.

Address———

American Boron Products Co., Inc.
Ramsdell and Elmwood Aves.
BUFFALO, N. Y.

Fill in the Coupon—do it today.

To the Metal Manufacturer or Individual Mixer of Metals:
PLEASE USE THIS COUPON
American Boron Products Co., Inc.,
Ramsdell & Elmwood Ave., Buffalo, N. Y.
Gentlemen:—Kindly send me complete details regarding the many ways whereby I can economize by using Boronic Alloying Metals.
MY HOME ADDRESS IS:
Name.....Street.....
City.....State.....

SPENCER TURBO-COMPRESSORS

Control of Air

Guarantees Uniform Results

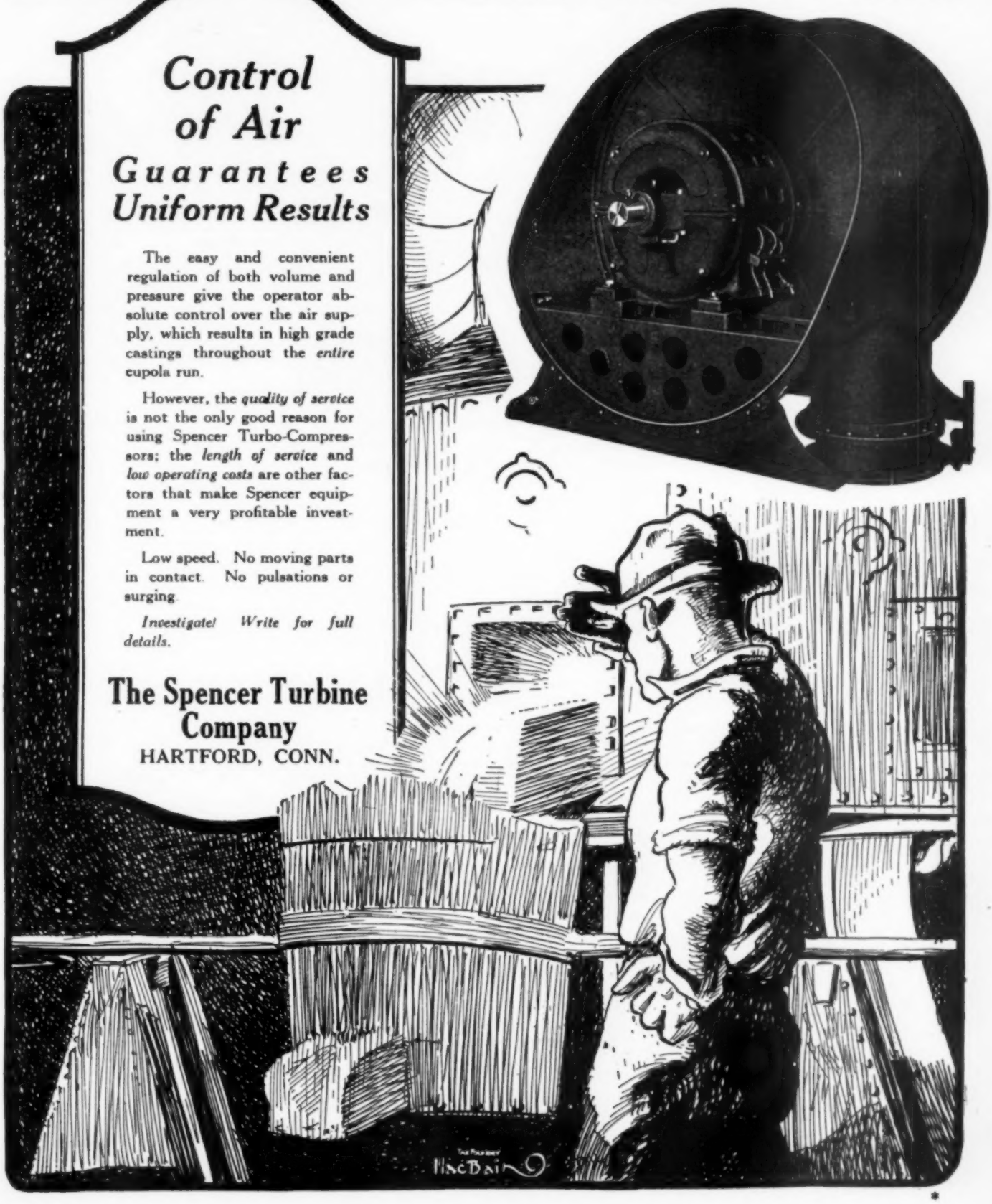
The easy and convenient regulation of both volume and pressure give the operator absolute control over the air supply, which results in high grade castings throughout the *entire* cupola run.

However, the *quality of service* is not the only good reason for using Spencer Turbo-Compressors; the *length of service* and *low operating costs* are other factors that make Spencer equipment a very profitable investment.

Low speed. No moving parts in contact. No pulsations or surging.

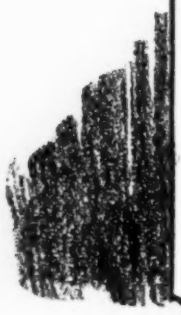
Investigate! Write for full details.

The Spencer Turbine Company
HARTFORD, CONN.



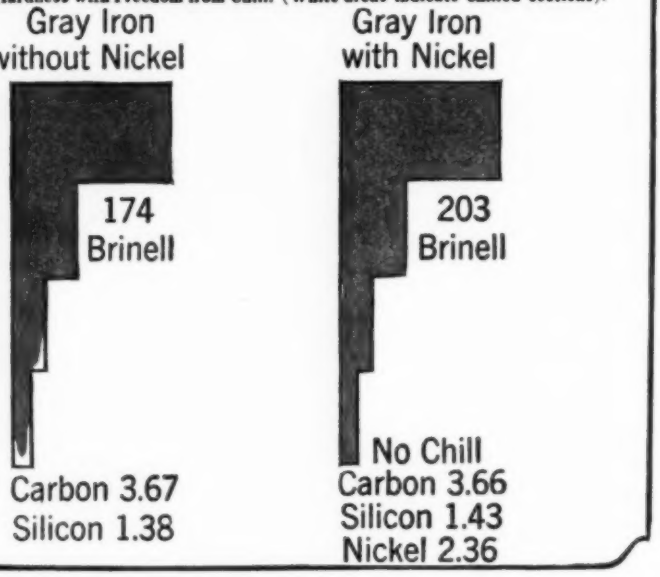
and now MAXIMUM MACHINABLE HARDNESS

This diagram, made from stepped-bar tests, shows that a plain Gray Iron casting having a hardness of only 174 Brinell has chilled corners and edges, while a Nickel Iron casting of the same carbon and silicon content has a Brinell hardness of 203 and yet has no white or unmachinable areas.



THE STEPPED-BAR TEST

Maximum Hardness with Freedom from Chill. (White areas indicate chilled sections).



To pour a MACHINABLE casting, with thin and varying sections, and a Brinell hardness of 200 or over, is a knotty problem, even to the experienced foundryman. But foundrymen, who have used Grade "F" Nickel, have learned that they can obtain the required hardness by adding Nickel. They have also found that this addition, at the same time, results in

—freedom from chill
—elimination of unmachinable corners, edges, etc.

In other words, you can now *extend the limitations of Cast Iron* and obtain "Maximum Machinable Hardness" through the simple addition of a small percentage of Nickel. Our engineers, with their extensive experience in solving foundry problems will gladly work with you towards securing "Maximum Machinable Hardness" in your castings.

SEND FOR NICKEL CAST IRON BULLETIN NO. 202

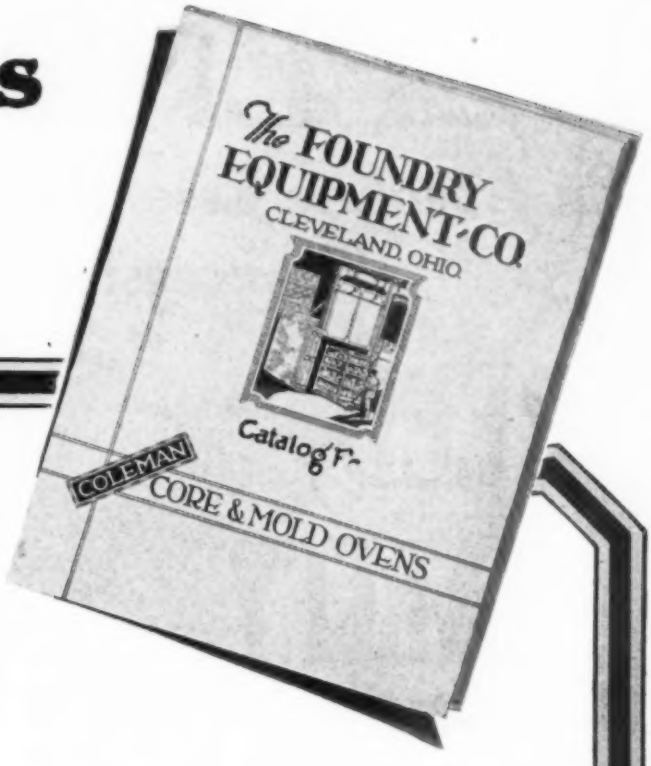
If you have not seen previous Nickel Cast Iron advertisements giving information about "Maximum Machinable Hardness," we will send you reprints on request. Watch this publication for subsequent advertisements on the same subject.

1.	Finer grain	—
2.	Increased hardness	—
3.	Uniform hardness	—
4.	Increased strength	—
5.	Reduction of chill	—
6.	Increased hardness with decreased chill	✓
7.	Better machinability with greater hardness	—
8.	Greater strength with better machinability	—
9.	Stabilized machinability	—
10.	Increased wear-resistance	—

INCo Nickel

THE INTERNATIONAL NICKEL COMPANY, 67 WALL STREET, NEW YORK CITY.

Do Your Files Contain



A fund of valuable information is contained in our new Catalog F, recently published.

—this Valuable Book?

Foundry Officials, Superintendents, and Foremen find much of interest throughout its 64 pages showing photographs of actual installations and covering every phase of efficient Baking and Handling of Cores, Drying of Molds, and the use of various Fuels.

Our new Catalog F represents, in a descriptive way, the direct result of 20 years of practical experience in the building of thousands of Core and Mold Ovens for representative foundries everywhere.

Write today for your copy of the new Coleman Oven Catalog F.

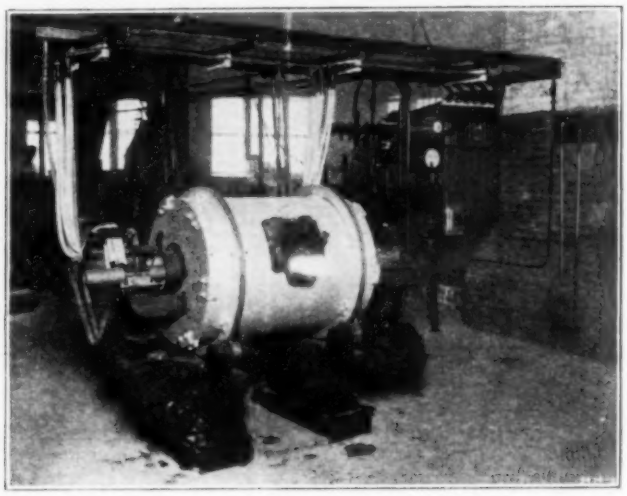
The FOUNDRY EQUIPMENT Co.

Builders of Foundry Ovens & Furnaces
Contracting Engineers *and* Manufacturers
CLEVELAND, OHIO

DEPENDABILITY—

An Absolute Essential in Any Successfully Managed Brass Foundry

SPEED, QUALITY, ECONOMY—



Are also necessary if you expect to develop in the highly competitive market of 1926.

THE DETROIT ELECTRIC FURNACE

Fills all these melting requirements. Sturdy, Rugged, Simple in Design, its freedom from complicated refractory structure insures its operation at maximum productive economy day in and day out for months. "Ask the man who uses one."

Let us send you a list of Detroit users.

Detroit Electric Furnace Co.

825 West Elizabeth St., Detroit **419 Call Bldg., San Francisco**

Less Handling— More MOVING!

There's a vast difference between handling and *moving* material in the foundry. Capable foundry engineers report that more than 200 tons of sand, iron, flasks and other items must be handled for every ton of castings produced.

But if half of the handling and rehandling of 200 tons for each ton of castings can be reduced to continuous moving *without rehandling*, think what the savings in labor and overhead will be for the average foundry's output!

Our local Material Moving Engineer can quickly describe some of the Cleveland Tramrail Systems that are cutting handling costs in hundreds of foundries. He is listed in your own telephone book under "Cleveland Electric Tramrail". Or a letter to the home office will receive the prompt attention of our engineering department.

Tramrail Stocks in the Following Cities

Albany	93 State St.
Birmingham	2028 First Ave.
Boston	44 Bromfield St.
Buffalo	1487 Hertel Ave.
Chicago	549 Washington Blvd.
Cincinnati	701 Union Central Bldg.
Denver	1226 E. 17th Ave.
Detroit	149 E. Larned St.
Indianapolis	606 State Life Bldg.
Los Angeles	430 E. Third St.
Louisville	513 Columbia Bldg.
New York	30 Church St.
Philadelphia	2401 Chestnut St.
Pittsburgh	412 House Bldg.
San Francisco	16 California St.
St. Louis	1122 Pine St.
St. Paul	516 Endicott Bldg.
Syracuse	404 So. Clinton St.
Toledo	2319 Elm St.

The equipment illustrated in this advertisement has been designed by this organization and is completely covered by patents. It cannot be used except in connection with the Cleveland Tramrail System.

Cleveland Electric Tramrail
Division of
The Cleveland Crane & Engineering Co.
Wickliffe, Ohio

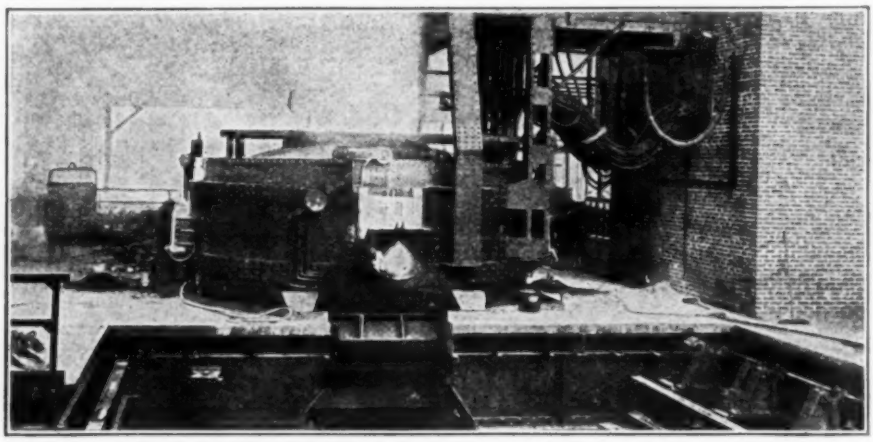
CLEVELAND TRAMRAIL SYSTEMS

AMERICAN BRIDGE COMPANY

71 Broadway, New York

Manufacturers of Steel Structures of all classes, particularly

BRIDGES *and* BUILDINGS



40 Ton Heroult Electric Furnace ready to pour

We also furnish and install

Heroult Electric Furnaces of One, Two, Three, Seven, Ten, Fifteen and Forty Gross Ton Capacities

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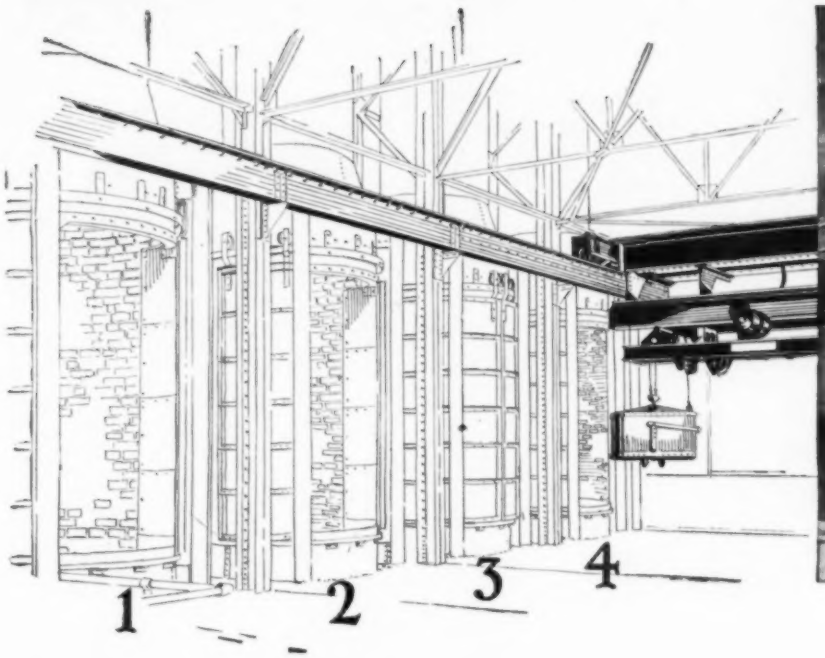
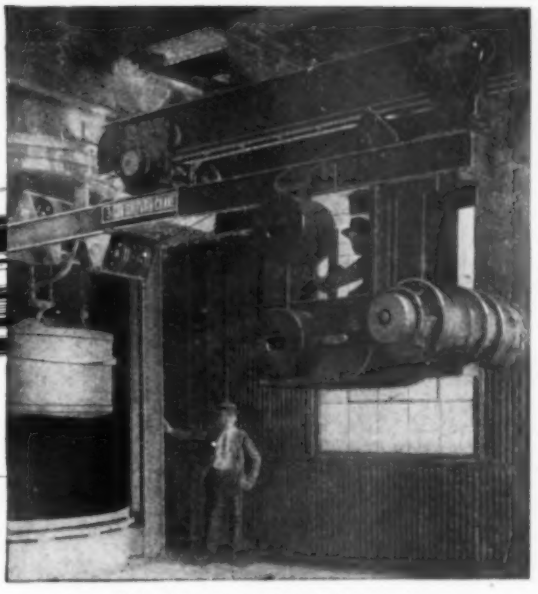
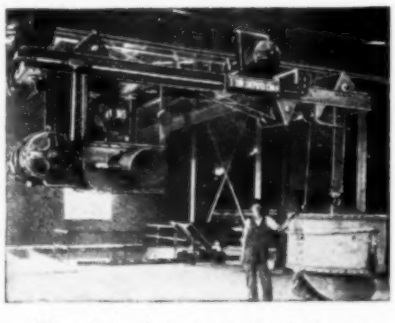
OFFICES IN PRINCIPAL CITIES





This gives one an idea of the charging hoist and bucket.

4 cupolas—one man —one Shepard Charger



The weight of the bucket on the bottom plate automatically locks them into position.

Bucket is being raised by the hoist through charging floor hatchway.

Buckets in position under coke hopper.

The Lynchburg Foundry Company is well known for its efficient production methods.

At the Radford, Virginia, plant of that company four cupolas of 6' inside diameter are used alternately, two with melting capacity of 40 tons an hour, being in service each day. The chargers weigh 2 tons and the Shepard Charging Hoist makes 20 trips an hour, or one trip every third minute.

Chargers are made up in Shepard Bottom Dump Buckets and moved on industrial tracks into position under charging platform hatchway and there picked up by the hoist.

Uncertainties of the human equation are eliminated. Proper distribution of metal, a contributory factor to good metal, is assured.

The Shepard method has eased one of the hardest tasks in the foundry, and one man, on the hoist, replaces eight men on the charging platform.

We shall be pleased to give you details of this and other money-saving installations. You assume no obligation in writing for this information and for the Shepard Foundry bulletin.

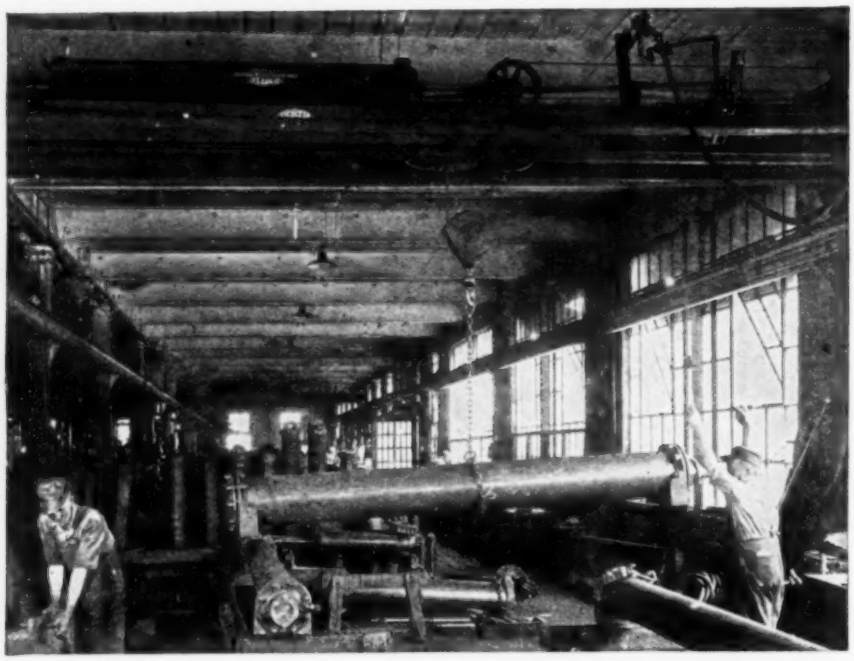
SHEPARD ELECTRIC CRANE & HOIST CO.
360 Schuyler Avenue, Montour Falls, N. Y.

Branches in principal cities

SHEPARD
ELECTRIC CRANES & HOISTS

Largest Manufacturer of Electric Hoists in America

CURTIS COMPRESSORS, HOISTS, CRANES, CAR WASH SYSTEMS, PORTABLE COMPRESSOR UNITS



Quick Handling of Heavy Materials

Go right now to that "neck of the bottle" in your plant where congestion is slowing up production. See if a Curtis Hoist, Crane or Trolley isn't *just the thing* to relieve the congestion!

A Curtis Hoist, either with fixed mounting, or crane-mounted as shown above, will handle heavy materials with a new ease.

A Curtis Hoist or Crane is low in first cost, and inexpensive to operate. Its great advantage is ease and accuracy of *control*. It lays its burden down in the *exact spot* wanted, in less time than other forms of hoist. Light weight—all steel—strong and safe.

This company is 73 years old, and has devoted 30 years to pneumatic engineering and the manufacture of compressed air machinery. If you have a materials handling problem, or a compressed air problem, put it up to Curtis.

Keep Your Air Lines Short!

Curtis Adjustable Trolley
Flexible Roller Bearings

Keeping air lines short is best practice. Compressed air, like other powers, loses efficiency when transmitted long distances. Leaks and line losses increase proportionately. However, compressed air can be laid out so it will prove to be unusually economical, both in first cost and in operation!

Moderate-sized compressors placed close to the work prove most satisfactory. Take a look at your air equipment with new eyes. Probably a very little improved planning will double the usefulness of compressed air in your plant! Give the subject a few moments' study right now while it is uppermost in your mind!

CURTIS Pneumatic Machinery Co.
1943 Kienlen Ave., ST. LOUIS, MO.
Branch Office: 518-9 Hudson Terminal, New York City.
Please send me full free information about Curtis Cranes, Hoists and Trolleys.
Name .....
Address .....
☐ Also send information about Curtis Model "A" Compressors.

CURTIS PNEUMATIC HOISTS CRANES COMPRESSORS

CURTIS PNEUMATIC MACHINERY COMPANY, ST. LOUIS, U.S.A.

Clark Tructractor hauls castings for Globe Malleable Iron & Steel Co., Syracuse, N. Y.

Four Clark Tructractors Do the Work of Fifty Laborers

"We have used Clark Tructractors for the past three years, during which time these 'iron mules' have hauled thousands and thousands of tons of steel.

"The four Tructractors we own have displaced 50 laborers whose job it was to push wheel barrows containing steel for hammers."

Globe Malleable Iron & Steel Co.

H. H. Elmer—Treas. and Gen. Mgr.

Clark 2 ton auto dump Tructractor carries 30 cu. ft. or 4,000 lbs.

Low side auto dump Clark Tructractor is ideal foundry machine.

CLARK TRUCTRACTOR COMPANY

1126 Days Ave.

BUCHANAN, MICHIGAN

All Clark machines are gasoline powered.

CLARK TRUCTRACTORS

CLARK TRUCTRACTOR CO.,
1126 Days Ave., Buchanan, Mich.

Please mail me Nielsen Survey and full information on Clark Tructractor models. F-December, 1926

Name .....

Company .....

Street .....

City .....

We employ ..... unskilled laborers.

Simplifying the Christmas Problem

MORE and more the intelligent public turns to books to settle the ever-perplexing problem of "what to give for Christmas".

And if books, why not select those that are useful and practical pertaining directly to the kind of work your friends are interested in. Books that will help to increase their knowledge and earnings—a gift that will be used and appreciated for years.

A few suggestions—

BARTON—Refining Metals Electrically **$6.00**
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This book is a compilation of the Data Sheets which have been published in THE FOUNDRY for many years and is a digest of rules, formulas and tables of constant use in modern foundry operations. It contains practical information that is essential to the foundryman, pattern-maker, metallurgist and student much of which never has been printed elsewhere. The book is arranged and cross indexed in such a way that subjects easily are found.

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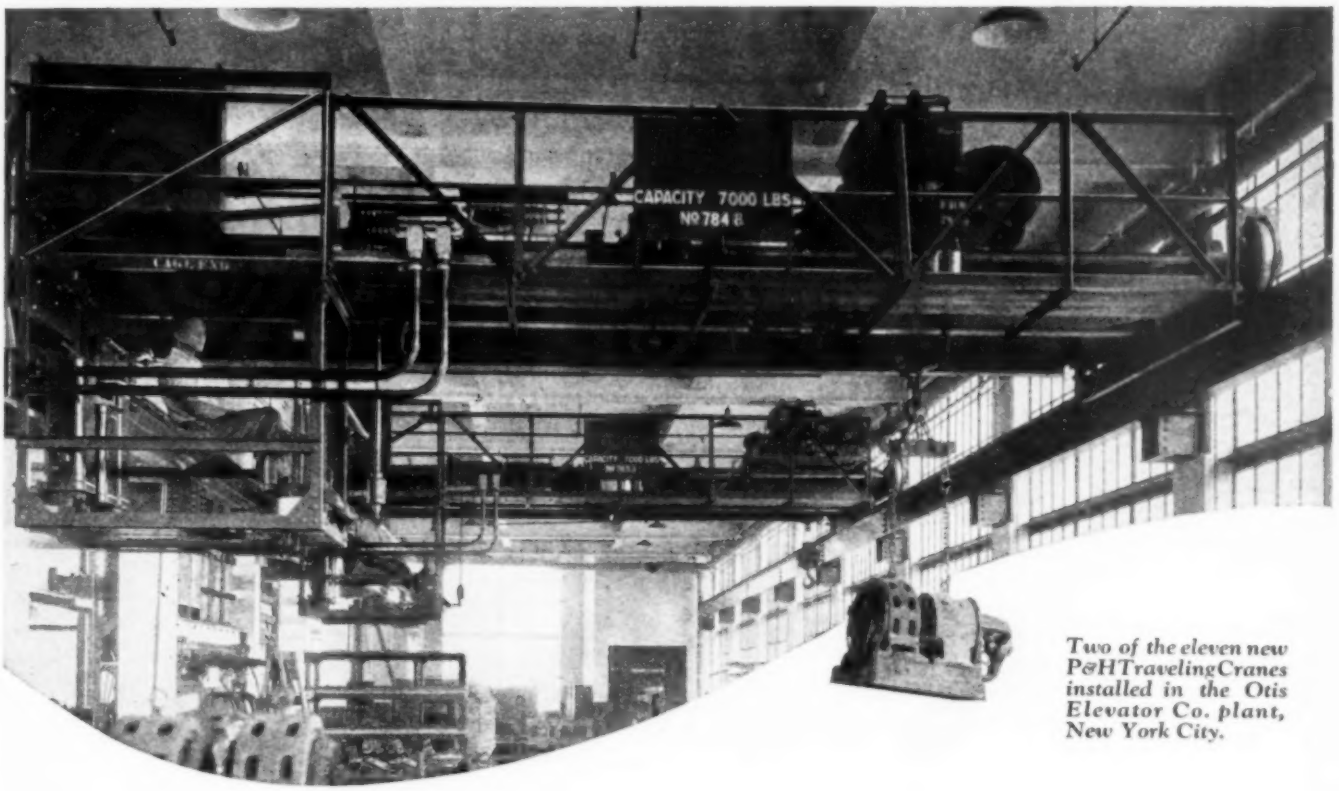
142 IF

When Experience Goes to Market



Two of the eleven new P&H Traveling Cranes installed in the Otis Elevator Co. plant, New York City.

WHEN the Otis Elevator Co., long experienced in the design and manufacture of elevators, skip hoists and other material handling equipment—equipped their new plant with traveling cranes, it is noteworthy that they selected and purchased eleven more P&H Cranes.

Being builders of high class hoisting equipment they knew what to look for—recognized the value of such features as the P&H design, the double cut gears, enclosed trolleys, M. C. B. bearings, speed and safety of control. And besides—having had five P & H Cranes in service for years they knew their dependability.

Because P & H Cranes are better built—cost less to operate and maintain, and provide speedy and safe material handling—they really cost the user less. —When experience goes to market more than just first cost is given consideration. Bulletin 408 gives detailed information.

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Established in 1884
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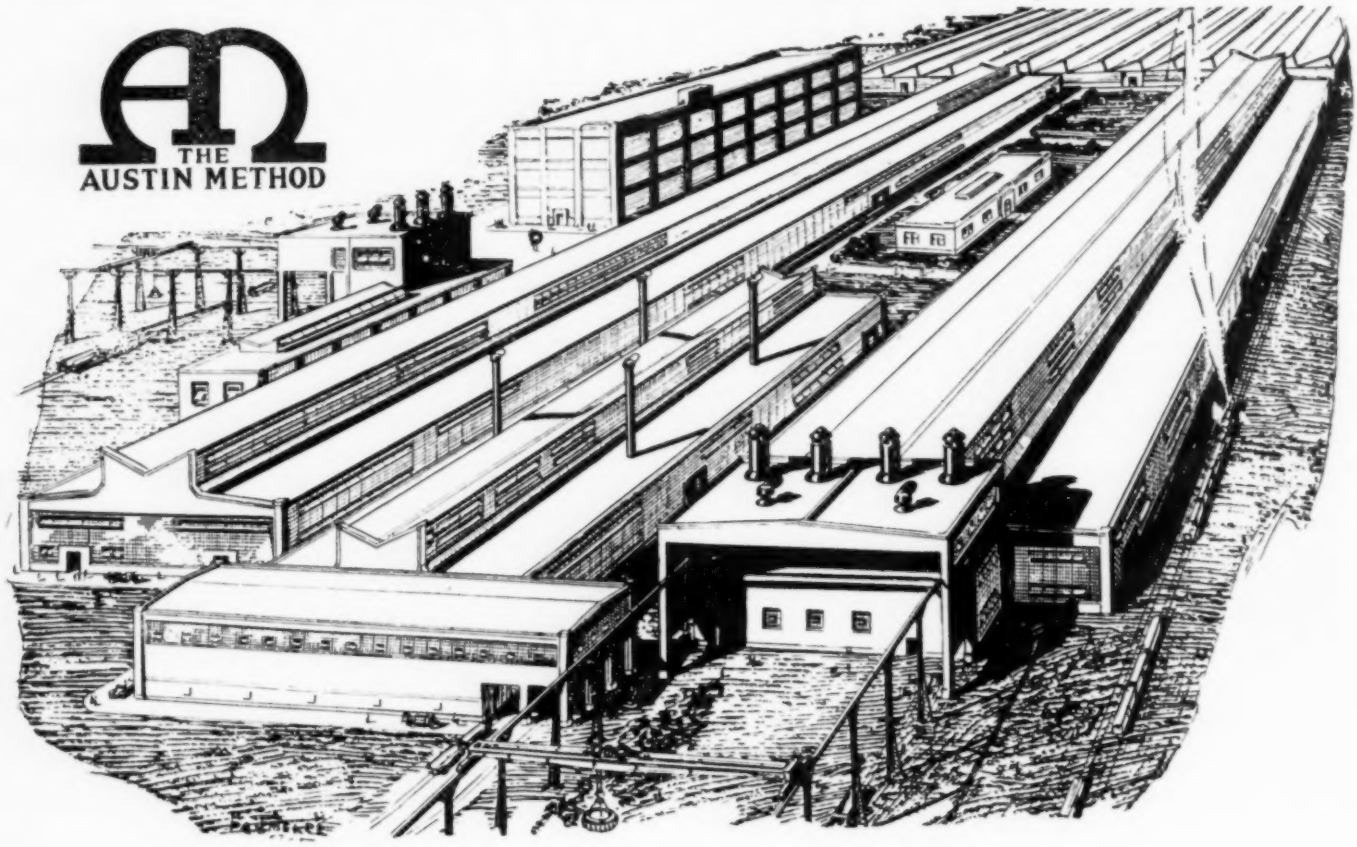
P&H CRANES and HOISTS

"GOOD FOUNDRY ENGINEERING IS WORTH MANY TIMES ITS COST"

THE AUSTIN METHOD



Industrial Reports a Feature of Austin Service

Due to their wide and varied manufacturing and foundry experience, Austin Foundry Engineers are in a unique position to serve you in determining whether

—to build a new foundry

—to increase capacity of your present foundry.

They can also help you determine whether you should control your castings "From Plans to Pour", or carry through to rough castings, finished castings or manufactured product.

This Austin Service may include an appraisal of present property, i. e. land, buildings and equipment—all or any one item.

When you place your foundry contract with Austin, you will have complete guarantees covering total cost of the complete project in advance; delivery date, with bonus and penalty clause if preferred; and quality of materials and workmanship.

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Save Man Power

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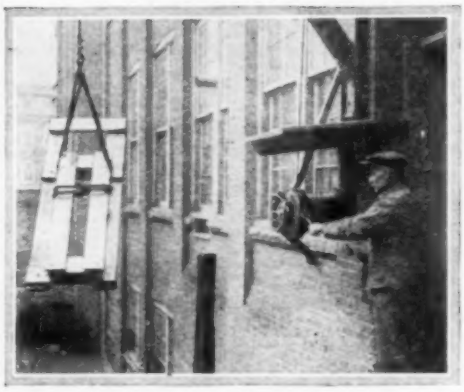

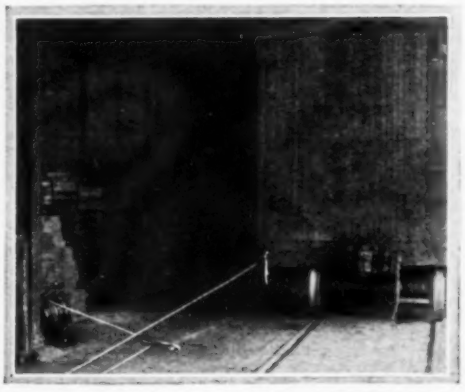

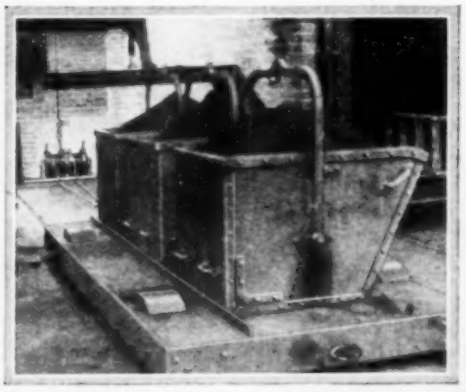

You can save man power and time in your foundry or shop by doing the little lifting and hauling jobs with

SULLIVAN TURBINAIR HOISTS

In one plant, 4 of these hoists are used.

One hoists patterns and lumber to an upper floor, one hauls freight cars in and out of the raw materials yard, one pulls full sand hoppers out on the foundry floor and pulls empties back under the mixer, and one hauls castings on a truck from one part of the foundry to another. These two are at right angles to the crane ways.

All are small jobs, but performed many times a day.

And outdoor uses are legion.

"Turbinair" and Electric Portable Hoists will haul a 100,000 lb. car on level track, or lift 2000 lbs. vertically on single line. Single or two drum models; drum capacity, 350 ft. 3/8 inch wire rope.

Ask for Pictorial Booklet "Handy Hoisting and Hauling"

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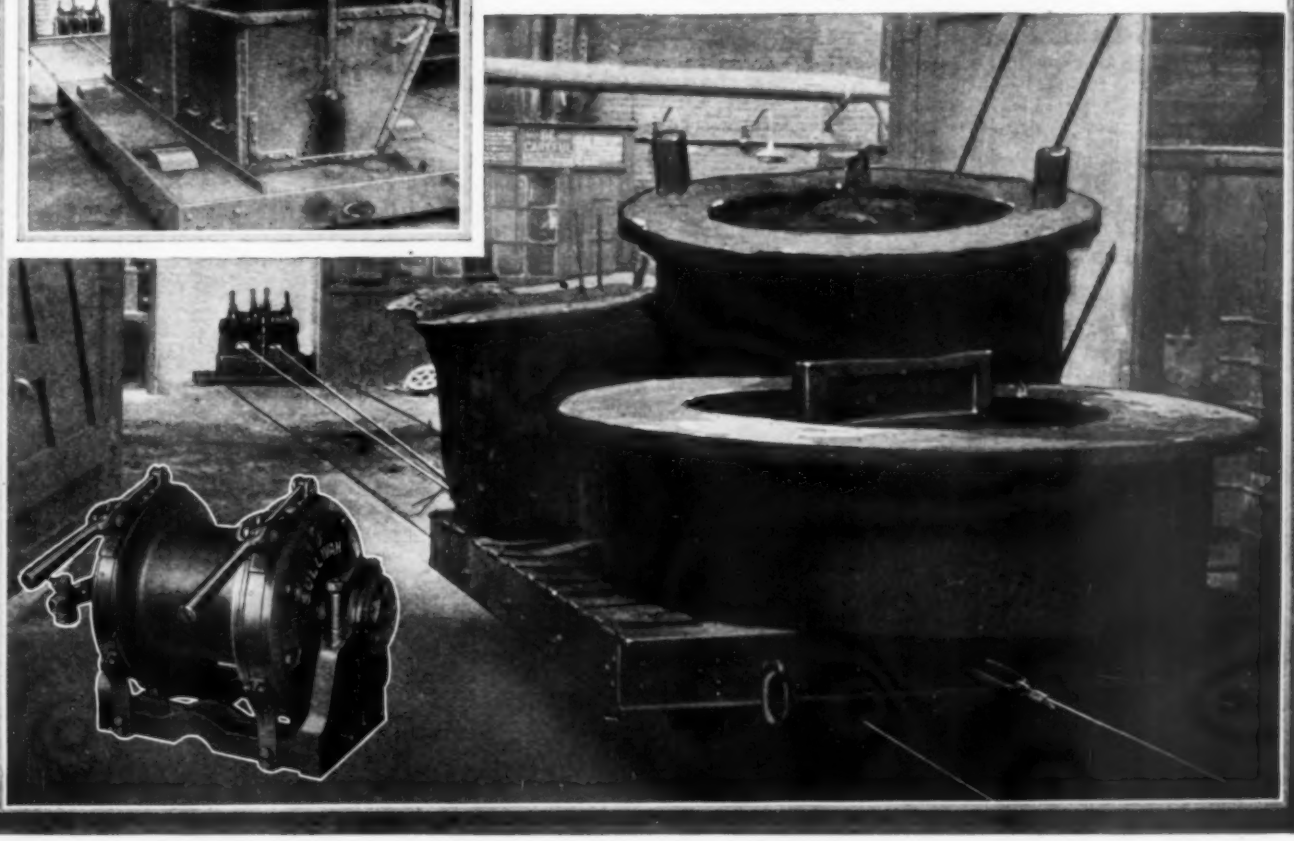
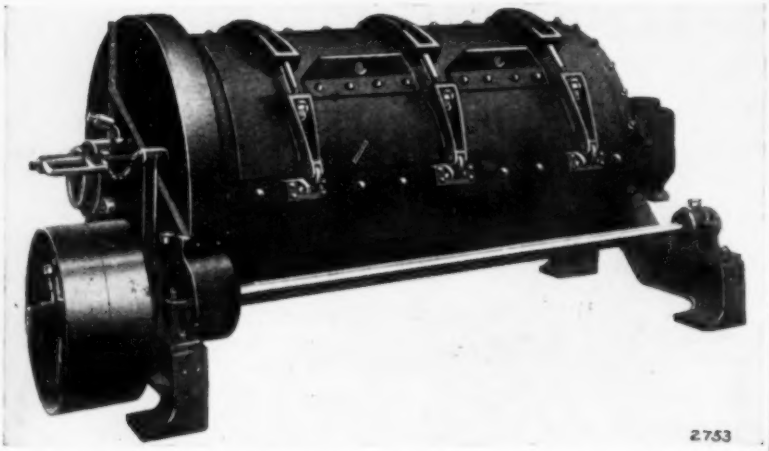


15 Points of Tumbling Mill Superiority



Class "A" Round Tumbling Mill with Positive Door Clamp. (Patent applied for.)

Every experienced foundry operator will appreciate these advantages:

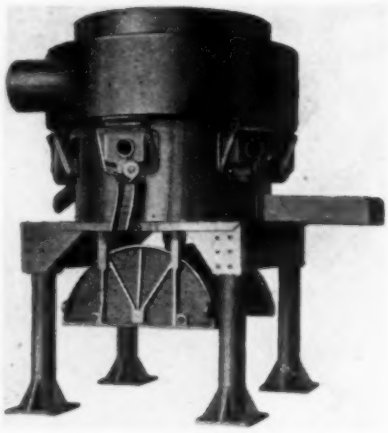
1. **Positive Door Clamp**—easily and quickly applied or removed.
2. **"Meehanite" Metal Trunnions**—give added strength and wearing qualities.
3. **Grease-Lubricated Trunnion Journal Bearings**—self-aligning; self-cleaning.
4. **"Meehanite" Metal Driving Gear**—gives maximum wear.
5. **Steel Driving Pinion**—pinion and gear protected by welded steel housings.
6. **Heads Well Ribbed**—ribs aid ready discharge of dirt through hollow trunnion.
7. **Perfect Alignment of Heads and Shell.**
8. **Head Liners Easily Renewed**—reinforced by ribs on head.
9. **Ample Space Between Head and Head Liners**—affords free passage for exhaust.
10. **Cast-iron Dust Box with Machined Bottom Valve** prevents waste of exhaust.
11. **Heavy Standards.**
12. **Rivets Countersunk Full Depth of Plate.**
13. **Through Bolts Used Throughout.**
14. **Interchangeable Parts**—permit quick replacement when necessary.
15. **Operation Before Shipment.**

For complete description of the above points, send for our new Tumbling Mill Bulletin No. 180.

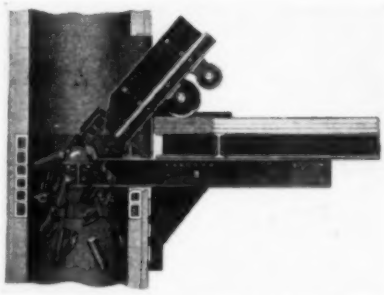
WHITING CORPORATION

15607 Lathrop Ave., Harvey, Ill. (Chicago Suburb)

See Page 65

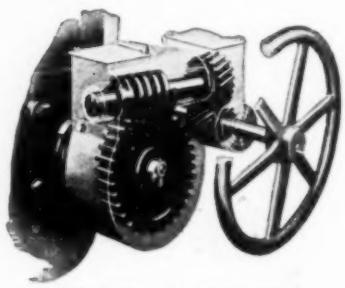


Body section of Whiting Special Cupola for long heats.

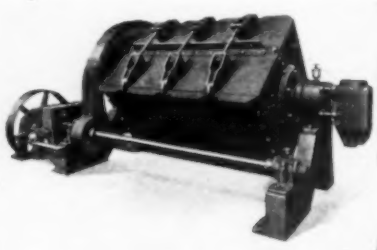


Whiting Balanced Cupola Charger Spreads charges evenly.

See Bulletin No. 182 for full description.



Helical Worm Ladle Gearing. Easy to turn—Safe and Steady.



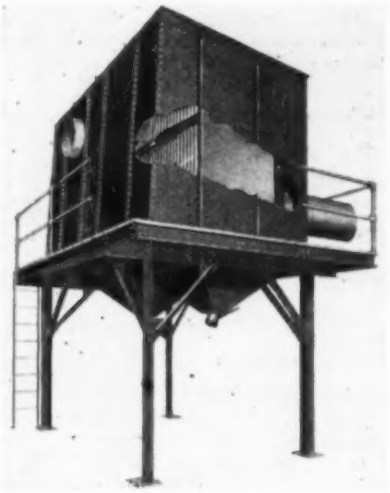
Class "B" Square Tumbling Mill, with Positive Door Clamp.

WHITING CRANES FOUNDRY EQUIPMENT RAILWAY SPECIALTIES

F12-15 Gray

The Whiting Dust Filter

Eliminates All Screen Vibration Troubles



One of the main difficulties with cloth-screen dust collecting apparatus has been caused by improper vibrating mechanisms for cleaning screens. Whiting cleaning-room engineers have perfected a single-bearing gyratory vibrator, as shown below. This vibrator, together with a steel rapping bar (which is fastened to each screen frame by built-in bolts), puts an end to this trouble. The force imparted to the screen by this gyratory vibrator, while of proper intensity to free the dust from the filter fabric, is not severe enough to injure the fabrication. The filter frame assembly is sufficiently flexible to permit vibration over the entire area of the filter fabric. Operates with a minimum of attention.

For complete details of this and other important features of the Whiting Dust Filter, send for new Bulletin No. 181.

WHITING CORPORATION

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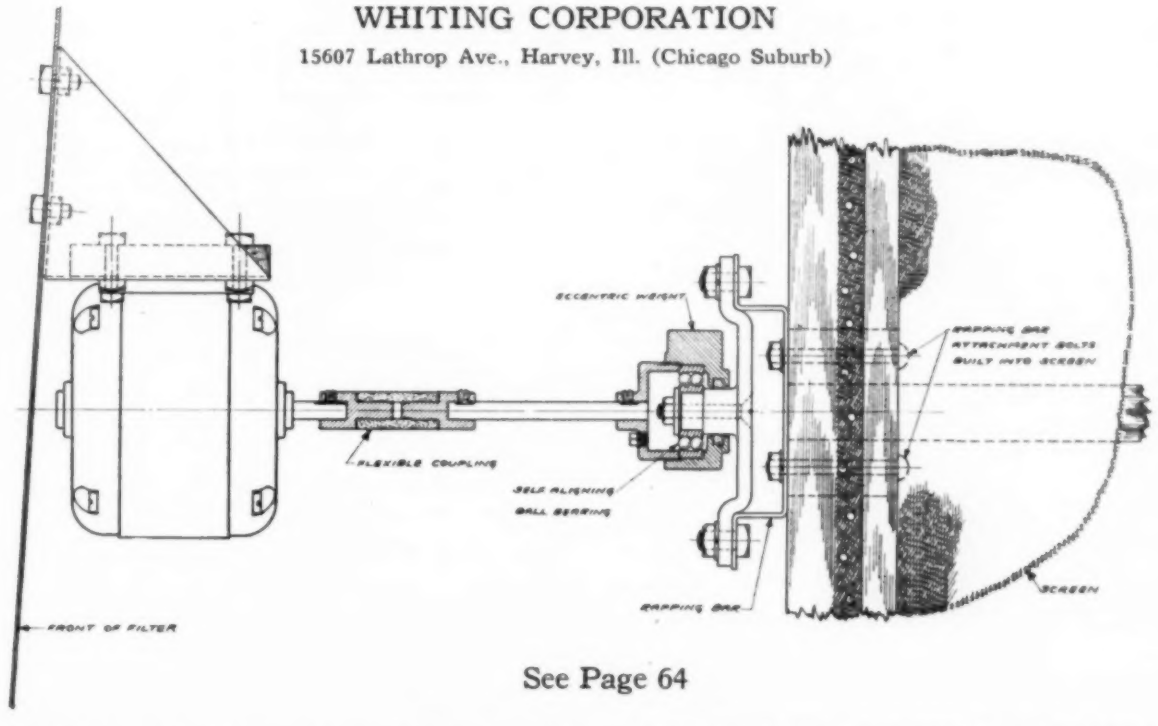

See Page 64

WHITING CRANES FOUNDRY EQUIPMENT RAILWAY SPECIALTIES

F 12-15 Gray

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Cost Hopes Versus Cost Facts

Salesmen usually think selling prices are too high. Treasurers think them too low. The trouble with a good many businesses, however, is that too many people are thinking about prices and too few about costs.

Thinking about costs cannot be done with one eye on the market and the other on net profits. It must be done with both eyes sharp on the facts of production. Only when those are seen clearly, can adjustments be made in favor of the net profits, or concessions to the market.

Of these cost facts few are more important than the fixed capital expenditures. "The effects of a wise or unwise policy in the handling of the fixed capital expenditures are permanent, far reaching, and frequently the determining factor in success or failure for the company." So states an eminent accounting authority.

The verification and adjustment of fixed asset accounts, accounting practices in regard to betterments, renewals, and additions, the adequacy of depreciation charges—all of these major factors are more safely provided for through proper appraisal service.

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CLAMPS (Flask)

Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

CLAMPS (Hose)—See HOSE CLAMPS

CLAY (Fire)—See FIRE CLAY

COAL

Hanna, M. A., Co., The, Leader-News Bldg., Cleveland, O.
Hillman Coal & Coke Co., First Nat'l Bank Bldg., Pittsburgh, Pa.

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Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COAL HANDLING MACHINERY

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

COAL, ORE AND ASH HANDLING MACHINERY

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

COKE

Bethlehem Steel Co., Bethlehem, Pa.
Hanna, M. A., Co., The, Leader-News Bldg., Cleveland, O.
Hillman Coal & Coke Co., First Nat'l Bank Bldg., Pittsburgh, Pa.
Rogers Brown & Crocker Bros., Inc., 21 E. 40th St., New York City
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

COMPRESSORS (Air)—See AIR COMPRESSORS

CONCRETE REINFORCEMENTS

Truscon Steel Co., Youngstown, O.

CONDENSERS (Surface and Low Level Jet)

Ingersoll-Rand Co., 11 Broadway, New York City.

CONSTRUCTION (Foundry Buildings)—See BUILDINGS (Foundry, Factory, Industrial)

CONSULTING FOUNDRY SPECIALISTS

Vickers, Chas., 60 S. Elmwood Ave., Buffalo, N. Y.

CONTRACTORS — See ENGINEERS AND CONTRACTORS

CONVERTERS (Steel)

Whiting Corporation Harvey, Ill.

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Arcade Mfg. Co., Dept. D., Freeport, Ill.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

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Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Roots, P. H. & F. M., Co., Connersville, Ind.

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Knefler-Bates Manufacturing Co., Indianapolis, Ind.
Mifflin Chemical Corp., Delaware Ave. and Tasker St., Philadelphia, Pa.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

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Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
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Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CORE DRYING PLATES—See PLATES (Core Drying)

CORE DRYING TRAYS

Truscon Steel Co., Youngstown, O.

CORE FLOUR

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Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

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Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

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Truscon Steel Co., Youngstown, O.
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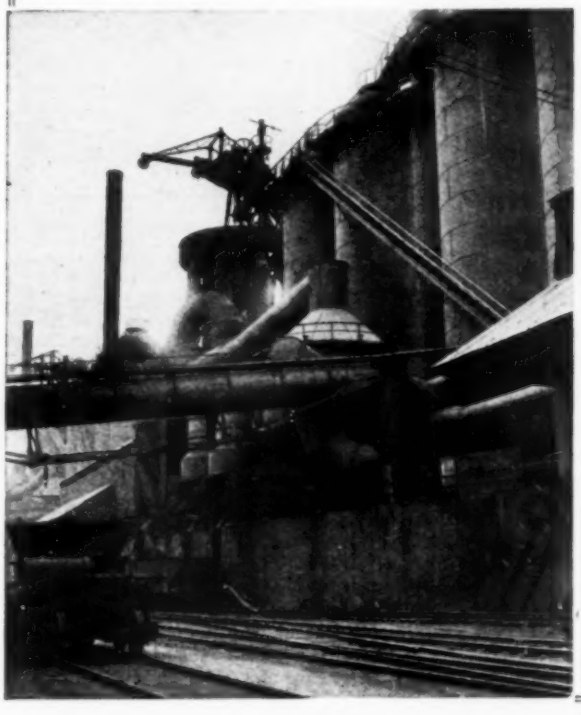

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Naugatuck Valley Crucible Co., Shelton, Conn.
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CYLINDERS (Oxygen)—See OXYGEN IN CYLINDERS

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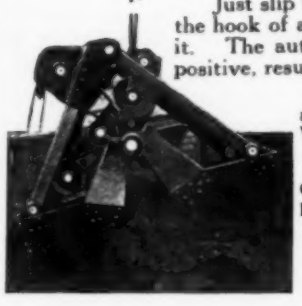

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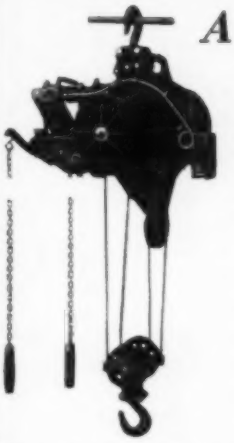

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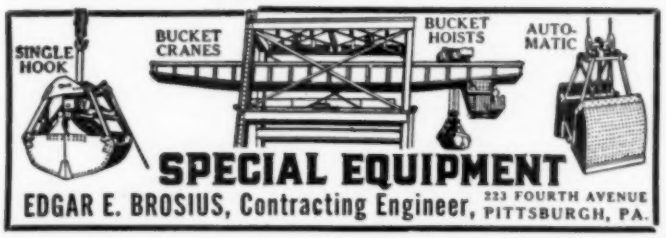

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Holcroft & Co., 6545 Epworth Blvd., Detroit, Mich.

FURNACES (Electric Melting)

American Bridge Co., 71 Broadway, New York City.
Detroit Electric Furnace Co., 2231 Park Ave., Detroit, Mich.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Malleable Melting)

Whiting Corporation, Harvey, Ill.

FURNACES (Melting)

Detroit Electric Furnace Co., 2231 Park Ave., Detroit, Mich.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
Whiting Corporation, Harvey, Ill.

FURNACES (Open Hearth)

Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

GAGGERS (Steel)

Franklin Core Rod & Gagger Co., Franklin, Pa.
Truscon Steel Co., Youngstown, O.
United Compound Co., 228 Elk St., Buffalo, N. Y.

GAS (Oxygen and Nitrogen)

Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

GAS BOOSTERS (Rotary)

Roots, P. H. & F. M., Co., Connersville, Ind.

GAS EXHAUSTERS (Rotary Positive Pressure)

Roots, P. H. & F. M., Co., Connersville, Ind.

GAS PUMPS (Rotary, Positive Pressure)

Roots, P. H. & F. M., Co., Connersville, Ind.

GAUGES (Welding)

Oxweld Acetylene Co., Newark, N. J.

GEAR HOBBERS

Adams Co., The, 175 Foster St., Dubuque, Iowa.

GEAR TESTERS

Adams Co., The, 175 Foster St., Dubuque, Iowa.

GLOVES (Asbestos)

Oxweld Acetylene Co., Newark, N. J.

GLOVES (Sandblast)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

GLUE POTS (Electric)

Wiegand, Edwin L., Co., 422 First Ave., Pittsburgh, Pa.

GOGGLES AND EYE PROTECTORS

Oxweld Acetylene Co., Newark, N. J.

GRAPHITE

Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
United States Graphite Co., The, Saginaw, Mich.

GRAPHITE (Boiler and Lubricating)

Dixon, Jos., Crucible Co., Jersey City, N. J.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cincinnati Electrical Tool Co., Madison and Edwards Rd., Cincinnati, O.
Strand, N. A., & Co., 5001-5009 North Lincoln St., Chicago, Ill.

GRINDERS (Emery)

Royersford Foundry & Machine Co., 52 Main St., Royersford, Pa.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Ingersoll-Rand Co., 11 Broadway, New York City.

GRINDING MACHINES

Cincinnati Electrical Tool Co., Madison and Edwards Rd., Cincinnati, O.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Snagging Motor Drive)

Cincinnati Electrical Tool Co., Madison and Edwards Rd., Cincinnati, O.

GRINDING PANS (Sand)

National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

GRINDING WHEEL STANDS (Bench and Floor)

Norton Co., Worcester, Mass.

GRINDING WHEELS—See ABRASIVE WHEELS

GRIT (Angular and Steel)

Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GUNS (Sandblast)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

HACK SAWS—See SAWS (Hack)

HAMMERS (Air Forging)

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

HAMMERS (Chipping and Riveting—Pneumatic)

Canton Pneumatic Co., 1718 Ninth St., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

HARDNESS TESTING & HEAT MEASURING INSTRUMENTS

Shore Instrument & Mfg. Co., Inc., Van Wyck Ave., & Carll St., Jamaica, L. I., New York.

HEATING UNITS (Electric)

Wiegand, Edwin L., Co., 422 First Ave., Pittsburgh, Pa.

HELMETS (Sandblast)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Pulmosan Safety Equipment Corp., 386 Jay St., Brooklyn, N. Y.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

HOISTING MACHINERY

Cleveland Crane & Engineering Co., Wickliffe, O.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

HOISTS (Air)

Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Whiting Corp., Harvey, Ill.

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Cleveland Electric Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, O.
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

HOISTS (Monorail)

Cleveland Electric Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, O.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

HOISTS (Pneumatic)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Ingersoll-Rand Co., 11 Broadway, New York City
Whiting Corp., Harvey, Ill.

HOISTS (Skip)

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

HOLDERS-ON

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Ingersoll-Rand Co., 11 Broadway, New York City.

HOODS (Leather Sandblast)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

HOSE (Pneumatic)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Ingersoll-Rand Co., 11 Broadway, New York City.

HOSE (Sandblast)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

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Oxweld Acetylene Co., Newark, N. J.

HOSE CLAMPS

Ingersoll-Rand Co., 11 Broadway, New York City.

HOSE COUPLINGS (Pneumatic)

Cleveland Pneumatic Tool Co., 3734 E. 78th St., S. E., Cleveland, O.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Ingersoll-Rand Co., 11 Broadway, New York City.

INDUSTRIAL RAILWAY EQUIPMENT—See RAILWAY EQUIPMENT

INDUSTRIAL TRACTORS—See TRACTORS (Industrial)

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INGOTS (Brass, Bronze, Copper, Nickel)

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

IRON ORE

Hanna, M. A., Co., The, Leader-News Bldg., Cleveland, O.

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American Foundry Equipment Co., Mishawaka, Ind.

JACKETS (Steel)

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Truscon Steel Co., Youngstown, O.

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American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

LADLE HEATERS AND DRYERS

Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.

LADLE LININGS

Alpha-Lux Co., Inc., 192 Front St., New York City.

LADLES

Paxson, J. W., Co., Luzerne and D Sts., Philadelphia, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
Truscon Steel Co., Youngstown, O.
Whiting Corp., Harvey, Ill.

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Flexible Shaft Machines

For the Foundry and Metal Pattern Shop

Type M7—1 H.P. for 8 x 1 grinding wheels.

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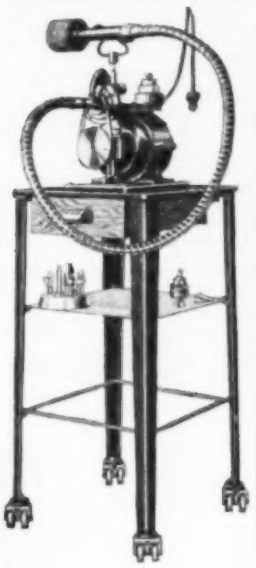

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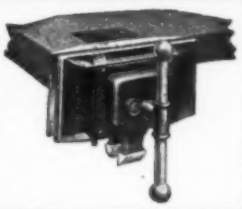

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A Grade and Size *for* Every Pattern Use

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California Sugar Pine

Characteristics are identical with those of the old northern white pine. Industry constantly demands more and more of the California species until it is now known everywhere as

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Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
United States Graphite Co., The, Saginaw, Mich.

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Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

LOADERS (Wagon and Trucks)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

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California White & Sugar Pine Manufacturers Association, 600 New Call Bldg., San Francisco, California.
Pickering Lumber Co., Kansas City, Mo.

LUMBER (Flask)
California White & Sugar Pine Manufacturers Association, 600 New Call Bldg., San Francisco, Calif.
Pickering Lumber Co., Kansas City, Mo.

LUMBER (Pattern)
Pickering Lumber Co., Kansas City, Mo.

LUMBER (Template)
California White & Sugar Pine Manufacturers Association, 600 New Call Bldg., San Francisco, Calif.
Pickering Lumber Co., Kansas City, Mo.

MAGNESIA (Fused)
Norton Co., Worcester, Mass.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

MAGNETS (Electro)
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

MAGNETS (Safety)
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

MANIFOLDS (Oxygen)
Oxweld Acetylene Co., Newark, N. J.

MATCH PLATES (Aluminum)
U. S. Aluminum Match Plate Co., 1269 W. 76th St., Cleveland, O.

METALLURGISTS
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.
Rohmer, Gabriel E., 516 5th Ave., New York City.

METAL LATH
Truscon Steel Co., Youngstown, O.

METALS (Nonferrous)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

METERS (Blast)—See BLAST METERS

MILLING ATTACHMENTS FOR PLANERS
Adams Co., The, 175 Foster St., Dubuque, Iowa.

MILLING STARS AND JACKS —See STARS (Tumbling Mill)

MILLS (Sand Mixing and Compounding)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

MIXERS (Sand)—See SAND MIXING MACHINERY

MOLASSES (Foundry)
Mifflin Chemical Corp., Delaware Ave. and Tasker St., Philadelphia, Pa.

MOLD DRYERS
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

MOLD OVENS
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Whiting Corp., Harvey, Ill.,
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

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Adams Co., The, 175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Beardsley & Piper Co., 2541 No. Keeler Ave., Chicago, Ill.
Berkshire Mfg. Co., 1011 Power Ave., Cleveland, O.
Demmler, Wm., & Brothers, Kewanee, Ill.
Hanna Engineering Works, 1759 Elston Ave., Chicago, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

MOLDING MACHINES (Roll Over)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

MOLDING MACHINES (Sand Throwing)
Beardsley & Piper Co., 2541 No. Keeler Ave., Chicago, Ill.

MOLDING MACHINES (Squeezer)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Manufacturing Co., 1011 Power Ave., Cleveland, O.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

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Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall St., New York City.

MONORAIL SYSTEMS
Cleveland Electric Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS (Electric)
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

NICKEL
International Nickel Co., 67 Wall St., New York City.

NICKEL (Boronic)
American Boron Products Co., Ramsdell and Elmwood Ave., Buffalo, N. Y.

NITROGEN (Gas)
Linde Air Products Co., 30 E. 42nd St., New York City.

NOZZLES (Sandblast)
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

OIL (Core)—See CORE OIL

OIL BURNING INSTALLATIONS
Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit, Mich.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.

OVENS (Annealing)
Whiting Corporation, Harvey, Ill.

OVENS (Core)—See CORE OVENS

OVENS (Enameling, Japanning, Etc.)
Foundry Equipment Co., 1831 Columbus Road, Cleveland, O.
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

OVENS (Mold)—See MOLD OVENS

OXY-ACETYLENE EQUIPMENT See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

OXY-ACETYLENE WELDING AND CUTTING—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

OXYGEN AND HYDROGEN
International Oxygen Co., Newark, N. J.

OXYGEN IN CYLINDERS
Linde Air Products Co., 30 E. 42nd St., New York City.

PAINT (Graphite)
United States Graphite Co., The, Saginaw, Mich.

PAINTS
Truscon Steel Co., Youngstown, O.

PANS (Grinding)—See GRINDING PANS (Sand)

PANS (Steel)
Truscon Steel Co., Youngstown, O.

PANS (Tempering)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

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Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

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PATTERN COMPOUND
American Foundry Equipment Co., Mishawaka, Ind.
Menefee Foundry Co., Ft. Wayne, Ind.

PATTERN LETTERS
Chain Products Co., 3924 Cooper Ave., Cleveland, O.

PATTERN LUMBER—See LUMBER (Pattern)

PATTERN LUMBER (White and Sugar Pine)
California White & Sugar Pine Manufacturers Association, 600 New Call Bldg., San Francisco, Calif.

PATTERN PLATES (Steel)
Truscon Steel Co., Youngstown, O.

PATTERN WAX
United Compound Co., 228 Elk St., Buffalo, N. Y.

PATTERNS (Wood, Metal)
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Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
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PLATES (Circular and Disk, Steel)
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PLATES (Core Drying)
Truscon Steel Co., Youngstown, O.

PLATES (Steel Pattern)
Truscon Steel Co., Youngstown, O.

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Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
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PNEUMATIC TOOLS—See TOOLS (Pneumatic)

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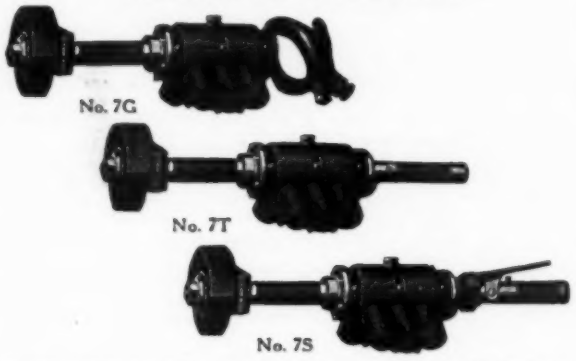
PORTABLE BALL BEARING EMERY GRINDER

Lightest and Fastest Air Grinder Made
Two Sizes No. 7 and No. 8



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Every Revolving Part in Cleco Grinders is mounted on Ball Bearings. Has Single Piece Connecting Rods.

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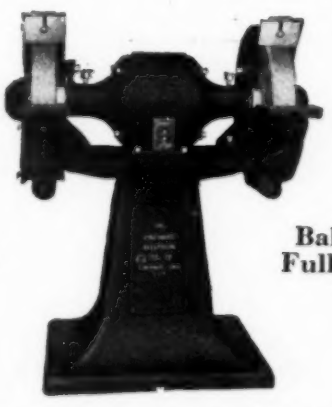

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Motor is ball bearing, fully enclosed and equipped with safety starting switch mounted in the base with push button control.

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Our business relations have always been of the most cordial nature. But at this Season, we wish to lay business relationships entirely aside and greet the foundry world, not merely as business friends, but rather as men whose personal friendships we count among our most treasured possessions.

We wish you all the Season's kindest Greetings.

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Roots, P. H. & F. M., Co., Connersville, Ind.

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Roots, P. H. & F. M., Co., Connersville, Ind.

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Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Rotary Pressure)

Roots, P. H. & F. M., Co., Connersville, Ind.

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Roots, P. H. & F. M., Co., Connersville, Ind.

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Berkshire Manufacturing Co., 1011 Power Ave., Cleveland, O.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.

RIDDLES (Pneumatic)

Adams Co., The, 175 Foster St., Dubuque, Iowa

RIDDLES (Sand)

Foundry Supplies Mfg. Co., 2221 Orchard St., Chicago, Ill.

RIVETERS — SEE HAMMERS (Chipping and Riveting—Pneumatic)

RODS (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.

RODS (Welding)—See WELDING RODS AND WIRE

SAND

Cape May Sand Co., Cape May, N. J.
Jones Sand Co., 277 East Long St., Columbus, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
Standard Silica Co., 39 S. LaSalle St., Chicago, Ill.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.

SAND (Bonding)

Falk Products Co., Cadillac, Mich.

SAND (Core)

Cape May Sand Co., Cape May, N. J.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
Standard Silica Co., 39 S. LaSalle St., Chicago, Ill.
U. S. Silica Co., 122 S. Michigan Ave., Chicago, Ill.
Whitehead Brothers Co., 17 Exchange Place, Providence, R. I.

SAND (French)

Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.

SAND (Molding)

Keener Sand & Clay Co., 514 Hartman Bldg., Columbus, O.
Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
Rogers Brown & Crocker Bros., Inc., 21 East 40th St., New York City.
Standard Silica Co., 39 S. LaSalle St., Chicago, Ill.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co., 17 Exchange Place, Providence, R. I.

SAND (Sandblast)

Cape May Sand Co., Cape May, N. J.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co., 17 Exchange Place, Providence, R. I.

SAND (Silica)

Standard Silica Co., 39 S. LaSalle St., Chicago, Ill.

SAND (Steel Molding)

Cape May Sand Co., Cape May, N. J.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
Standard Silica Co., 39 S. LaSalle St., Chicago, Ill.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co., 17 Exchange Place, Providence, R. I.

SANDBLAST ABRASIVES (Steel Shot and Grit)

Globe Steel Abrasive Co., Dept. F, Mansfield, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT AND ACCESSORIES

American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Cleveland Blow Pipe & Mfg. Co., 6950 Kinsman Rd., Cleveland, O.
Direct Separator Co., Inc., Syracuse, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Mott Sand Blast Mfg. Co., 4611-21 Flournoy St., Chicago, Ill.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Luzerne and D Sts., Philadelphia, Pa.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

SANDBLAST NOZZLES — See NOZZLES (Sandblast)

SANDBLAST SHOT (Steel)—See SHOT (Steel Sandblast)

SANDBLAST TUMBLING BARRELS—See TUMBLING BARRELS

SAND CONVEYING AND HANDLING EQUIPMENT

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.

SAND CONVEYING AND HANDLING MACHINERY

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAND CUTTING MACHINES

American Foundry Equipment Co., Mishawaka, Ind.

SAND CUTTING AND SCREENING MACHINES

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Whiting Corp., Harvey, Ill.

SAND DRYERS

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

SAND GRINDING PANS—See GRINDING PANS (Sand)

SAND MIXERS, CUTTERS AND SIFTERS

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAND MIXING MACHINERY

American Foundry Equipment Co., Mishawaka, Ind.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.

SAND RAMMERS

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAND RAMMERS (Pneumatic)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Ingersoll-Rand Co., 11 Broadway, New York City.

SAND RECLAIMERS

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

SAND SIFTERS

Adams Co., The, 175 Foster St., Dubuque, Iowa
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.

SAND SLINGERS

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SASH (Steel)—See STEEL SASH

SASH (Steel Continuous)

Truscon Steel Co., Youngstown, O.

SASH OPERATING DEVICES

Truscon Steel Co., Youngstown, O.

SAWS (Cold Inserted Tooth)

Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SAWS (Cold Metal)

Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SAWS (Hack)

American Saw & Mfg. Co., Springfield, Mass.

SAWS (Metal Band)

American Saw & Mfg. Co., Springfield, Mass.

SCALING HAMMERS

Ingersoll-Rand Co., 11 Broadway, New York City.

SCLEROSCOPES

Shore Instrument & Mfg. Co., Inc., Van Wyck Ave. & Carll St., Jamaica, L. I., New York.

SCREENS (Sand)

National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The, 5151 St. Clair Ave., Cleveland, O.

SEACOAL

Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.
Stevens, Frederic, B., Inc., Larned and Third Sts., Detroit, Mich.

SEPARATORS (Magnetic)

Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co., 241 24th Ave., Milwaukee, Wis.

SEPARATORS (Magnetic and Electro Magnetic of all Kinds)

Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

SEPARATORS (Moisture-Oil)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

SEPARATORS (Sand)

Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

SHAKE-OUT FLOORS (Pneumatic)

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

SHEET METAL WORKERS

Cleveland Blow Pipe & Mfg. Co., 6950 Kinsman Rd., Cleveland, O.

Whitehead's
Foundry Sands

are laboratory controlled and foundry tested

We are amply equipped and prepared to furnish the proper sand for any variety of casting, having unexcelled resources and facilities. We are producers and shippers of Albany and North River Molding Sand, New Jersey Molding Sand, Lumberton Sand, Millville Gravel, Cattarugus Molding Sand, Windsor Lock Molding Sand, Strong and Sharp Silica Steel Molding Sand, Furnace Bottom Sand, Screened Jersey Fire Sand, Jersey Fire Clay, Kaolin and Cupola Daub, Core Sands and Blast Sands. Importers of French Sand.

We also carry in our various warehouses a complete line of foundry supplies.

WHITEHEAD BROTHERS COMPANY

Providence NEW YORK Buffalo

FOUNDRY SANDS, SUPPLIES AND EQUIPMENT

PORTAGE SANDS

MOLDING OVER 98% SILICA SANDBLASTING

THE PORTAGE SILICA CO., YOUNGSTOWN, OHIO.

JONES SAND COMPANY

Molding Sands for Aluminum, Brass, Iron and Steel Castings

277 East Long Street

COLUMBUS, OHIO

Sand and Fire Clay

Miners of Gallia Red, Nickel Plate Sandusky, Core and Silica Molding Sands. Fire Brick and Fire Clay

The Keener Sand & Clay Co.

814 Hartman Bldg. Columbus, Ohio.

FRANKLIN GAGGERS

Patent No. 978783

Four times the grip of ordinary gaggers

MADE OF SQUARE TWISTED STEEL

SIZES: ⅛"-5/32"-3/16"-¼"-5/16" READY FOR QUICK SHIPMENT.

FRANKLIN CORE ROD & GAGGER CO., Franklin, Penna.

Cape May Sand

WITHOUT doubt there are foundrymen who have never used Cape May Sand. We want to place a sample in their hands. We want them to know the surprising advantages of Cape May quality. And we want them to benefit from the advantages of our service which has won hundreds of friends for Cape May Sands.

We can furnish undried or kiln dry sand blast sand in five sizes, Nos. 0, 1, 2, 3 and 4. Double screened to insure uniform size.

Our service is exceptional! Write for those samples.

Cape May Sand Company
512 Washington Street
Cape May, N. J.

CAPE MAY SAND CO. CAPE MAY CITY, N.J.

SHOT (Steel, Sandblast)

American Steel Abrasives Co., Galion, O.
Harrison Supply Co., Inc., 5 Dorchester Ave. Extension, Boston, Mass.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Steel Shot & Grit Co., 61st and A. V. Ry., Pittsburgh, Pa.

SHOT AND GRIT (Sandblast)

American Steel Abrasives Co., Galion, O.
Globe Steel Abrasive Co., Dept. F, Mansfield, Ohio.
Harrison Supply Co., Inc., 5 Dorchester Ave. Extension, Boston, Mass.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SILICA (Ground and Grits)

Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.

SLIP JACKETS (Steel)

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Truscon Steel Co., Youngstown, O.

SNAP FLASK BOTTOM PLATES —See PLATES (Bottom Snap Flask)

SNAP FLASK TRIMMINGS

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Berkshire Manufacturing Co., 1011 Power Ave., Cleveland, O.

SNAP FLASKS—SEE FLASKS

SNAP MOLD JACKETS—See JACKETS (Snap Flask and Mold)

SOAPSTONE

Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.

SPIEGELEISEN

Bethlehem Steel Co., Bethlehem, Pa.

SPLIT PATTERN MACHINES

Berkshire Mfg. Co., 1011 Power Ave., Cleveland, O.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SPRUE CUTTERS

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, Ohio.

SQUEEZERS (Hand and Power)

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Manufacturing Co., 1011 Power Ave., Cleveland, O.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

STARS (Tumbling Mill)

Paxson-Taggart, Inc., Luzerne and D Sts., Philadelphia, Pa.

STEEL

Bethlehem Steel Co., Bethlehem, Pa.

STEEL (Alloy)

Timken Roller Bearing Co., Canton, O.

STEEL (Alloy, Cold Drawn)

Timken Roller Bearing Co., Canton, O.

STEEL (High Speed)

Bethlehem Steel Co., Bethlehem, Pa.

STEEL (Structural)

American Bridge Co., 71 Broadway, New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Penn Foundry & Mfg. Co., Reading, Pa.

STEEL (Tool)

Ludlum Steel Co., Watervliet, N. Y.

STEEL BANDS

Adams Co., The, 175 Foster St., Dubuque, Iowa.

STEEL BARGES

American Bridge Co., 71 Broadway, New York City.

STEEL SASH

Truscon Steel Co., Youngstown, O.

STEEL SHOT

Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Globe Steel Abrasive Co., The, Mansfield, O.
Harrison Supply Co., Inc., 5 Dorchester Ave. Extension, Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL TOWERS

American Bridge Co., 71 Broadway, New York City.

TALC

Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

TITANIUM

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TONGS (Crucible)

Paxson, J. W., Co., Luzerne and D Sts., Philadelphia, Pa.
Whiting Corp., Harvey, Ill.

TOOL GRINDERS

Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

TOOLS (Electric)

Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

TOOLS (Pneumatic)

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

TORCHES AND BURNERS (Oxy-Acetylene)

Oxweld Acetylene Co., Newark, N. J.

TRACK AND RAIL SUPPLIES

Bethlehem Steel Co., Bethlehem, Pa.

TRACTORS (Industrial)

Clark Tructractor Co., Buchanan, Mich.

TRAMRAIL SYSTEMS

Cleveland Electric Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, O.
Whiting Corp., Harvey, Ill.

TRIPOLI

American Tripoli Co., Seneca, Mo.

TROLLEYS

Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.

TRUCKS (Annealing Oven)

American Foundry Equipment Co., Mishawaka, Ind.
Whiting Corp., Harvey, Ill.

TRUCKS (Foundry)

Chase Foundry & Mfg. Co., The, Columbus, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Whiting Corp., Harvey, Ill.

TRUCKS (Industrial)

Clark Tructractor Co., Buchanan, Mich.
Penn Foundry & Mfg. Co., Reading, Pa.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Corp., Harvey, Ill.

TRUCKS (Welding)

Oxweld Acetylene Co., Newark, N. J.

TRUSSES (Steel)

Truscon Steel Co., Youngstown, O.

TUBES

Timken Roller Bearing Co., Canton, O.

TUBES (Cold Drawn Seamless Steel)

Timken Roller Bearing Co., Canton, O.

TUMBLING BARRELS

Arcade Mfg. Co., Dept. D, Freeport, Ill.
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Luzerne and D Sts., Philadelphia, Pa.
Royersford Foundry & Machine Co., 52 Main St., Royersford, Pa.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.
Whiting Corp., Harvey, Ill.

TUMBLING MILLS

Whiting Corp., Harvey, Ill.

TURBO BLOWERS—See BLOWERS

TURNTABLES

Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Chase Foundry & Mfg. Co., The, Columbus, Ohio.
Whiting Corp., Harvey, Ill.

VALVES

Westinghouse Traction Brake Co., Wilmerding, Pa.

VALVES (Air)

Jenkins Bros., 80 White St., New York City.

VALVES (Back Pressure)

Oxweld Acetylene Co., Newark, N. J.

VALVES (Blow-Off and Cut-Off)

Berkshire Mfg. Co., 1011 Power Ave., Cleveland, O.

VALVES (Gas, Water and Steam)

Jenkins Bros., 80 White St., New York City.

VALVES (Pneumatic)

Cleveland Pneumatic Tool Co., The, 3734 E. 78th St., Cleveland, O.

VENTILATING ENGINEERS

Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

VENTILATING SYSTEMS

Cleveland Blow Pipe & Mfg. Co., 6950 Kinsman Rd., Cleveland, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Luzerne and D Sts., Philadelphia, Pa.

VENTILATORS

Arex Co., 111 W. Washington St., Conway Bldg., Chicago, Ill.

VIBRATORS

Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co., 1011 Power Ave., Cleveland, O.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

VIBRATORS (Electric)

Foundry Supplies Mfg. Co., 2221 Orchard St., Chicago, Ill.

VISES (Patternmakers)

Yost Manufacturing Co., Meadville, Pa.

WAX (Core, Wire, Pattern, Vent)

United Compound Co., 228 Elk St., Buffalo, N. Y.

WEDGES (Foundry)

Sterling Wheelbarrow Co., Milwaukee, Wis.

WELDING (Gas)

Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

Imperial Brass Mfg. Co., 1203 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co., Newark, N. J.

WELDING FLUXES

Oxweld Acetylene Co., Newark, N. J.

WELDING RODS AND WIRE

Oxweld Acetylene Co., Newark, N. J.

WHEELBARROWS

Sterling Wheelbarrow Co., Milwaukee, Wis.

WHEELS (Grinding)—See ABRASIVE WHEELS

WINDOWS (Rolled or Pivoted Steel)

Truscon Steel Co., Youngstown, O.

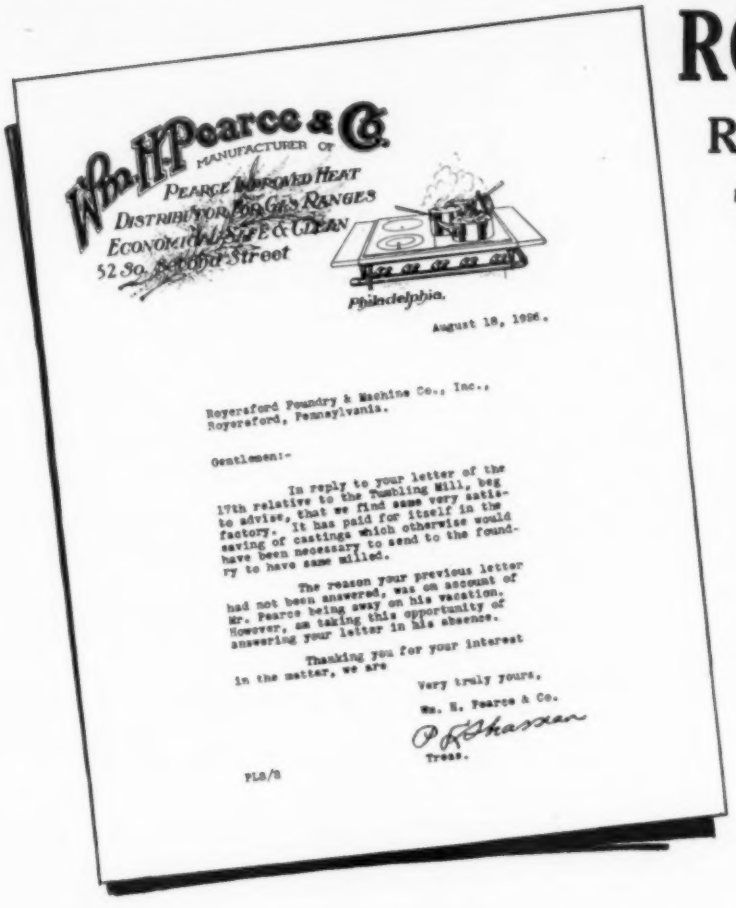
WIRE (Welding)—See WELDING RODS AND WIRE

WOOD WORKING MACHINERY

Ingersoll-Rand Co., 11 Broadway, New York City.

ZINC (Boronic)

American Boron Products Co., Inc., Ramsdell and Elmwood Ave., Buffalo, N. Y.



Wm. H. Pearce & Co.
MANUFACTURER OF
PEARCE IMPROVED HEAT
PEARCE IMPROVED GAS RANGES
DISTRIBUTOR FOR GAS RANGES
ECONOMICAL, SAFE & CLEAN
52 So. Second Street
Philadelphia.

August 18, 1926.

Royersford Foundry & Machine Co., Inc.,
Royersford, Pennsylvania.

Gentlemen:-

In reply to your letter of the 17th relative to the Tumbling Mill, beg to advise, that we find same very satisfactory. It has paid for itself in the saving of castings which otherwise would have been necessary to send to the foundry to have same milled.

The reason your previous letter had not been answered, was on account of Mr. Pearce being away on his vacation. However, am taking this opportunity of answering your letter in his absence.

Thanking you for your interest in the matter, we are

Very truly yours,
Wm. H. Pearce & Co.
P. L. Shassian
Treas.

PLS/S

ROYERSFORD
ROLLER BEARING
TUMBLING MILLS

This advertisement is no. 2 of a series—see no. 3 next month.

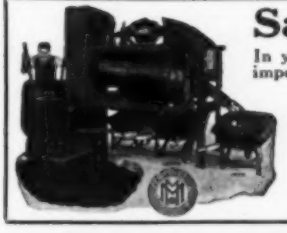
We can say a lot of good things about Royersford Tumbling Mills—every one true, too—

BUT—
You're bound to give your attention to what Mr. Shassian of Wm. H. Pearse & Co. says, for they tested the mill in actual service.

We'll be delighted to quote—or to send an engineer to look over your requirements—

Royersford Foundry and Machine Co., Inc.
OFFICE & WORKS: **Royersford, Penna.**

The ACME MAGNETIC PULLEY
standardized separation
TAKES THE IRON OUT OF MOULDING SAND AND RECOVERS IRON FROM CRUSHED OR QUENCHED SLAG
The ACME MAGNETIC PULLEY COMPANY
9 South Clinton Street Chicago, Illinois



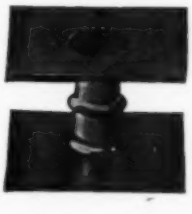
Save Your Iron!
In your foundry *magnetic separation* is just as important as an increase in the price of castings, it means virtually the same thing, as increased profit may be had in recovering your losses from the refuse by "HIGH DUTY" Magnetic Separation. Trained engineers and 25 years experience are yours to command. Think it over.
Magnetic Manufacturing Co.
241 24th Ave. Milwaukee, Wis.

ALL TYPES
ALL SIZES
CHAPLETS for any Requirement
We specialize in chaplets used for eliminating shop work such as drilling, turning, making slots, dovetails, shapes, etc.
UNITED STATES CHAPLET AND SUPPLY CO.
140 Cedar St., New York City

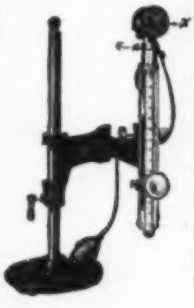
MUMFORD MOLDING MACHINES
INCREASE PRODUCTION
SIMPLE, RUGGED CONSTRUCTION
EASY TO OPERATE
HANNA ENGINEERING WORKS
1761 ELSTON AVE., CHICAGO, ILL.

Philadelphia Chaplets

Chaplets are not a side line with us. We specialize in the production of Chaplets. Any of our customers will tell you that we make the Best.



Philadelphia Chaplet & Mfg. Co.
School Lane & P. & R. Ry., Wissahickon
Philadelphia, Pa.



Hardness Testing
with the SCLEROSCOPE gives you the advantage over your competitors. Our *booklet* on the Science and Testing of metals will be sent free on request.

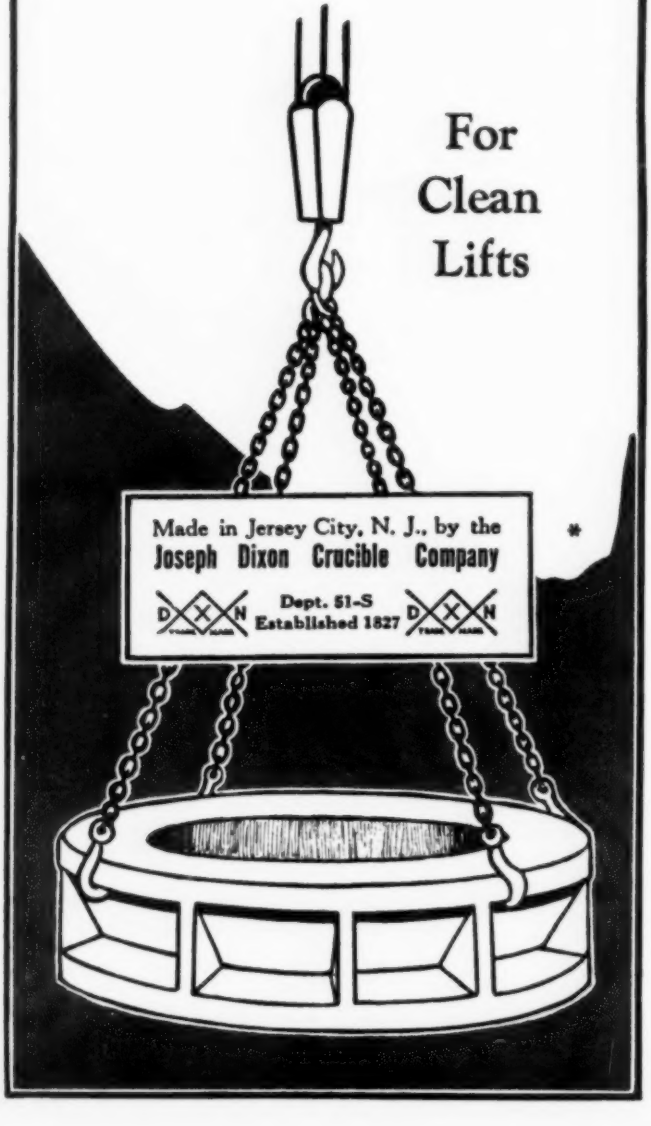
Heat Indications
in the foundry are now most successfully made with the Pyroscope. Inexpensive, simple, etc.
Pamphlet free

The Shore Instrument & Mfg. Co.
INCORPORATED
Van Wyck Ave. and Carll St. Jamaica, N. Y.

Dixon's Graphite Facings

Dixon's Graphite facings are easily applied—they "slick" well—and by insuring clean lifts, reduce cleaning and machining costs.

There is a Dixon grade to suit every class of work and meet every foundry use. Tell us your shop conditions and we'll gladly send you samples. *The results will surprise you!*



You'll Get Cleaner Castings With

CORE-MOL
A MOLASSES BINDER

There's nothing in Core-Mol to cause gases, "pin-holes" or other kinds of trouble common to most binders.

Core-Mol is an efficient, safe, economical and dependable molasses binder.

Prices on request. Send for trial barrel. Leading foundrymen use Core-Mol with complete satisfaction. List of users supplied for reference.

MIFFLIN CHEMICAL CORPORATION
Philadelphia, Pa.
New York Warehouse,
527 Hudson Street.

AMERICAN TRIPOLI COMPANY

(Incorporated 1892)

Subsidiary of Barnsdall Corporation

SENECA, MISSOURI, U. S. A.

Cable Address: "Tripoli, Seneca"

Reg. U. S. Pat. Off.
Seneca Standard Tripoli

Codes: A B C 5th & 6th: Marconi; Bedford McNeil

Reg. U.S.Pat.Off.
"Be Square" Products

Approved by 140 Plants

This Core Machine Increases Production.

We build Core Machines to suit your conditions.

Gas Stove Burners.
Plumbing Goods.
Intricate Cores.

Correspondence Solicited

Wm. Demmler & Bros.
Kewanee, Ill.

A PLUMBAGO THAT WILL PEEL YOUR CASTINGS PERFECTLY

THAT'S

MEXICAN PLUMBAGO

Try it and be convinced.

The United States Graphite Company

Saginaw, Michigan

New York Philadelphia Pittsburgh Chicago St. Louis San Francisco

---

Falk-O-bond THE NEW EFFICIENT SAND BONDER

Look for our full page ads in the first-of-the-month issues, and write us for particulars.

Falk Products Company, Cadillac, Mich.

BURY AIR AND GAS COMPRESSORS VACUUM PUMPS

ALL SIZES, ALL TYPES, ALL PRESSURES TO MEET ANY ENGINEERING REQUIREMENTS

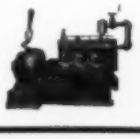
BURY COMPRESSOR CO., 1746 Cascade St. ERIE, PA.

General Catalog 125 gives a concise, comprehensive view of all PENNSYLVANIA products. It should be in the reference files of every user of air compressors or centrifugal pumps. If you have not obtained your copy, send for it now.

Main Office and Works, Easton, Pa.

PENNSYLVANIA PUMP & COMPRESSOR CO.

Westinghouse Traction Brake Co.



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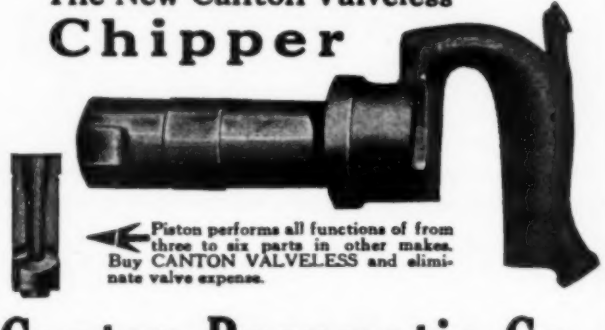

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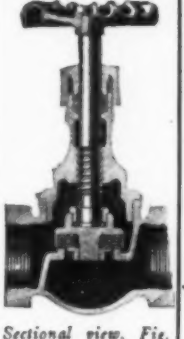

Sectional view, Fig. 106, screwed, Jenkins Standard Bronze Globe Valve.

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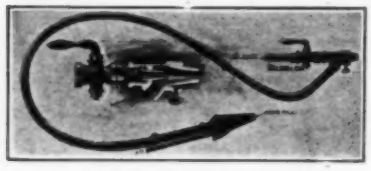

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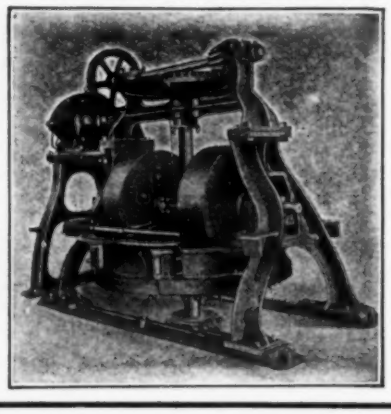

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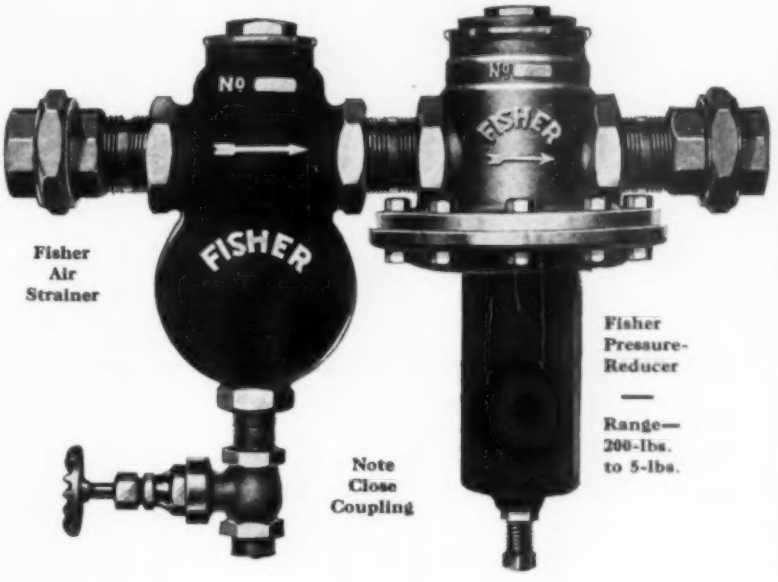

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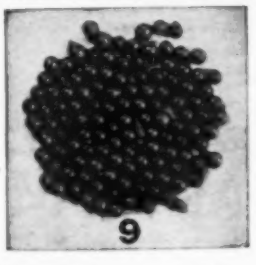

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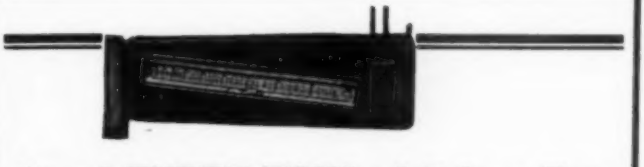

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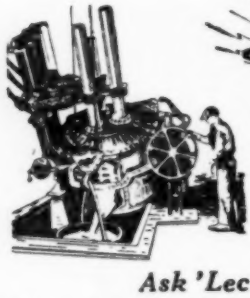

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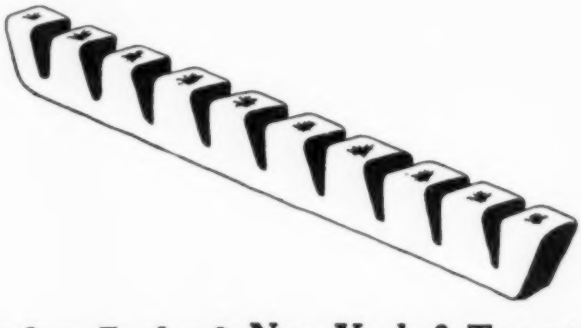

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BY COMPETENT FOUNDRYMAN, FIFTEEN YEARS FOREMAN AND SUPERINTENDENT IN GRAY IRON, WHITE IRON, BRASS AND BRONZE. EVERY CLASS OF WORK, MOLDING MACHINES AND PRODUCTION WORK. STEADY MAN, NOT AFRAID OF WORK. ADDRESS BOX 114, THE FOUNDRY, CLEVELAND.

PRACTICAL FOUNDRYMAN, AT PRESent employed as salesman on line to foundries, would like to hear from a company desiring salesman for first of year. Address Box 121, THE FOUNDRY, Cleveland.

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TO WRITE US FOR TECHNICALLY-TRAINED, PRACTICAL GRAY IRON OR STEEL FOUNDRY FOREMEN OR SUPERINTENDENTS. NO CHARGE.

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MILWAUKEE, WIS.

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Positions Wanted

BUSINESS MANAGER, WITH APPROVED record in managing and building up foundry, machine and allied industries desires connection with reliable company. Experience includes complete responsibility for all office, sales and factory activities. Address Box 986, THE FOUNDRY, Cleveland.

MALLEABLE PLANT SUPERINTENDENT with successful record, up-to-date in modern methods, and capable of assuming full charge, desires position with reliable firm. Best of references. Address Box 982, THE FOUNDRY, Cleveland.

TECHNICAL ASSISTANT:—MECHANICAL engineer, 32, thoroughly experienced mechanical-structural designer on industrial plant buildings, structural steel and plate work, furnace and brickwork, material-handling equipment, labor-saving machinery, etc.; with exceptional knowledge of foundry, pattern and machine shop practice, having devoted special attention to rigging up molding machines for production on light and medium-weight work, desires responsible position. Present salary $4000. Good reason for desiring change. Address Box 992, THE FOUNDRY, Cleveland.

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FOUNDRY FOR SALE

A complete, new, steam heated, fire proof, steel sash and concrete Gray Iron Foundry, equipped with a 35′ span crane, sand blast room and barrel, 267 foot Gardner compressor, large Swartout core oven, 5 drawer Monarch core oven, two Sly Motor driven tumbling mills, two Tabor power molding machines, 5 ton Paxson Colliau cupola, Wilbraham motor driven positive blower, electric lift to charging floor, full equipment of Hines aluminum taper flasks and metal jackets. Nine concrete material bins, track above for dumping material direct from cars, and an abundance of land for extensions and waste dumping ground for a hundred years.

Location, 67 miles from New York City, with daily motor truck deliveries at low rates to the world's best casting market.

To a thoroughly practical and experienced foundryman, who has a fair working capital, we will sell, below cost, on payments extending over 10 years with interest at 5%. A wonderful opportunity to acquire a practically perfect foundry at very nearly rental rates.

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Address Box 123,
THE FOUNDRY, Cleveland.

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Have professional engineers with extensive plant experience who can therefore better appreciate your requirements, and aid you in locating a suitable foundry.

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Woolworth Bldg., N. Y. C. Whitehall 8412

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FOR SALE:—40 FOUR PIN CAST IRON brass molders flasks. All in good condition, size 16″ x 11″ x 3″ x 3″. Address Richardson, 155 Mass Ave., Boston, Mass.

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FOR SALE

Fox Lathe No. 2, plain head and universal turret and countershaft.
Engine Lathe 16″ x 6′ plain feed, with 7″ turret, saddle & countershaft.
Blount Grinder, double end, with countershaft.
6″ Sensitive Drill Press.
25 ft. 1 15/16″ steel line shafting with hangers and pulleys.
American band saw machine.
American fan type blowers.

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Cleveland, O.

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1—Square Tumbling Mill, 34¾x34¼x40″.
1—Blower Fan No. 30, Type S. B., Ex. 11″ inlet, 12″ outlet—Clarage Foundry & Mfg. Co., Kalamazoo, Michigan.
1—No. 6 Whiting Cupola, 35 Ft. High, with lining—Whiting Foundry Equipment Co., Harvey, Illinois.
1—No. 10 Cupola Blower—Buffalo Forge Co., Buffalo, N. Y.

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MORRISON, ILLINOIS

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WANTED:—A 1000 POUND ELECTRIC steel furnace, must be in good condition. Pacific Steel Boiler Corporation, Bristol, Pennsylvania.

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FOR SALE:—NO. 2, 6′ DIA. PAN SIMPSON Intensive Sand Mixer; excellent condition. Address Box 122, THE FOUNDRY, Cleveland.

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1—10-ton Milwaukee Crane Trolley to run on rails 7'0" center, main hoist 27½ H. P. Westinghouse Type K-No. 2-230 V. D. C. Motor, 535 RPM-racking motor Westinghouse Type K No. 7-230 V. D. C.-4½ H. P. 715 RPM.

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2—International Type F, 26 x 8.—26 x 12.
3—International Type A, 26 x 12.
2—International Type G, 24 x 10.
1—Osborn No. 403, Roll-over Jolt.
1—Osborn No. 406-S Jolt Stripper.
1—Osborn No. 406—Roll-over Jolt.
2—Davenport No. 34-Power-roll-over Jolt.
2—Nichols Type B-32 Comb. Jolt and power-squeeze.
10—Adams stationary single rod Squeezers.

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2—36 x 36 x 60" Sly Tumblers, arranged for double file drive.
1—48 x 72 Sly Tumbler, tight and loose pulley.
1—30 x 48 Sly Tumbler, tight and loose pulley.
1—34 x 34 x 108"—1¼" plate, Sly Tumbler arranged for clutch drive.

SPRUE CUTTERS

1—Bush heavy-duty type Sprue Cutter for steel, 20" throat.
1—Obermayer Power Sprue Cutter.

SAND CUTTERS

1—American Sand Cutter, 72" between wheels 10 H. P. 3-60-220 Motor.
1—Wadsworth Spirocut—72" between wheels, 3 motors, 3-60-440.

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1—Ingersoll-Rand 2-stage Corliss inlet valve type, 16 x 14 and 10 x 14, 600 cu. ft. cap.

MISCELLANEOUS

1—No. 24 Gardner Disc Grinder, ball-bearing type on bed plate with extended shaft.
1—Magnetic Separator for brass, bronze and aluminum.
4—Coombs Gyratory Riddles 110 V. single phase 60 cycle AC Motor.
2—36" Band Saws—iron table.
2—E. C. & M. 55" Magnets.

Write for our late list No. 50 covering complete FOUNDRY EQUIPMENT.

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2012 W. 13th STREET,
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FOR SALE
At Greensburg, Penna.

1—18 x 8 x 5 Tabor Power Portable Combination, Shockless jarring Roll-over and pattern drawing Molding Machine Complete. First class condition.....$100.00
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We have a very complete and excellent cast iron flask equipment for these machines complete with bars.

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STRIPPING PLATE MACHINES

46—Stripping Plate Machines, all sizes, Type D, E, O, B, K, & J Pridmore. Type T & Y International. Osborn.

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2—14" x 8" draw Type H Pridmore.
1—45P Little Wonder Osborn.
1—16" x 8" draw Type R International.
1—24" x 6" draw Tabor.
1—29" x 24" x 12" draw Type HP Hand Ram Power Roll Pridmore.

SQUEEZERS—HAND AND POWER

3—38" Single Rod Hand Squeezers Adams.
1—10" B. & B. Air Squeezer Portable.
1—10" Air Squeezer, Stationary, Tabor.
2—No. 1 Modern Machines, Arcade.

JOLT MACHINES
PLAIN AND COMBINATION

4—12" x 16" x 8" draw type TJ Jolt Strippers, International.
1—12" x 24" x 8" draw Type TJ Jolt Strippers, International.
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1—No. 1 U. S. Jolt Squeeze Stripper, new.
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5—No. 80 Jolt Squeeze Strippers, Osborn.
3—No. 81 Jolt Squeeze Strippers, Osborn.
1—Special Jolt Stripper for Piston Copes Arcade.
2—30" Jolt Rollovers, Grimes.

MISCELLANEOUS EQUIPMENT

1—13 ft. Tractor Type Sand Slinger.
1—Two ton steel converter, cupola and motors.
1—One ton steel converter, cupola and motor.

Our Re-Manufactured machines are guaranteed to be in as good working condition as new equipment. If the machine you need is not listed above, write us, as this list contains only equipment ready for shipment.

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3018 West 21st Place
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Motor Driven by 5 H. P., 220 volt D. C. Motor. Suitable for threading bolts and tapping nuts from ¾ to 2½" either right or left hand. A-1 Condition. Price: $500. f.o.b. cars Chester, Pa.

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Phila., Pa.

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For Sale

FOR SALE

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(1)—No. 10 Paxson Cupola.
(1)—66" Paxson Cupola. (95% new.)
(1)—No. 4 Connersville Blower.
(1)—No. 4 Vertical type Wilibraham Green Blower.
(1)—No. 6-B Wilibraham Green Blower.
(1)—No. 5 Wilibraham Green Blower.
(1)—36" x 36" Sly Mill.
(1)—42" x 42" x 66" Sly Mill.
(2)—24" x 48" Sly Mills Grope Drive.
(1)—Blystone Sand Mixer (no screen).
(1)—No. 3 Standard Mixer with conveyor.
(1)—Paxson coke fired core oven (new) 10' x 18' x 18', all parts including (2) cars.
(1)—No. 1 Type G. D. Pangborn Barrel.
(1)—No. 2 Type G. D. Pangborn Barrel.
(1)—18" Tabor, hand ram, Rollover, Pattern Draw.
(1)—36" Electric Controller Magnet.
(1)—5-ton Niles crane, 3-motors, 220-VDC, 19'-22" span.
(1)—20-ton P & H, 35'-0" span, 220-VDC.
(1)—20-ton P & H, 58'-0" span, 220-VDC.
(2)—20-ton Niles, 50'-0" span, 220-VDC.

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1—5-hp Westinghouse direct current type D generator 124-V, 40 amp., 1500 rpm.
1—10-hp Western Electric induction motor, 3 phase, 60 cycle, 220-V, 1200 RPM, with slide base and pulley.
1—20-hp Fairbanks-Morse type KBV motor, 220-V, 1200 RPM, 3 phase, 60-cycle, with slide base and pulley.
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Low prices on sizes 3, 4, 5, 5½, 6, 6½. Will arrange belt or gear drive complete. Also No. 1-P American Fan. Sprague AC ton hoist. Air and Gas Engineering Co., Piqua, Ohio.

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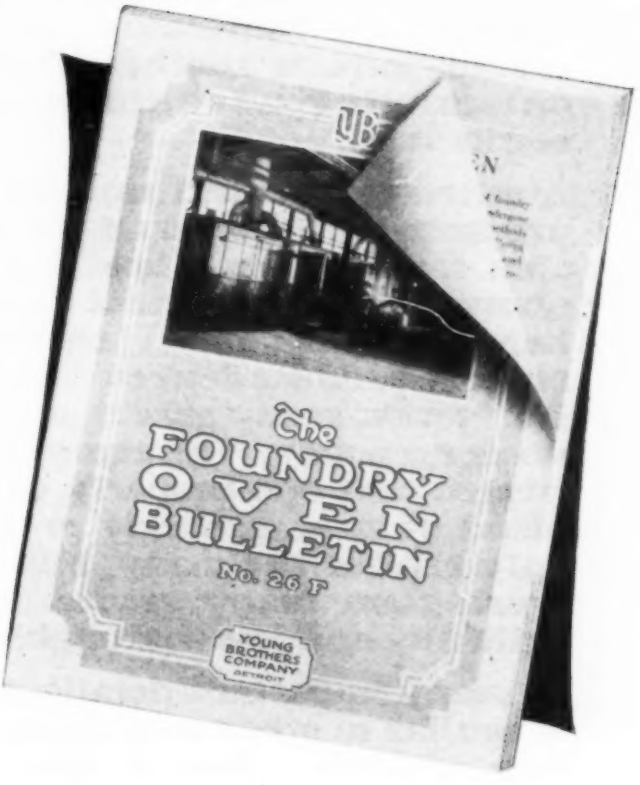

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2873

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